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METAL FINISHING

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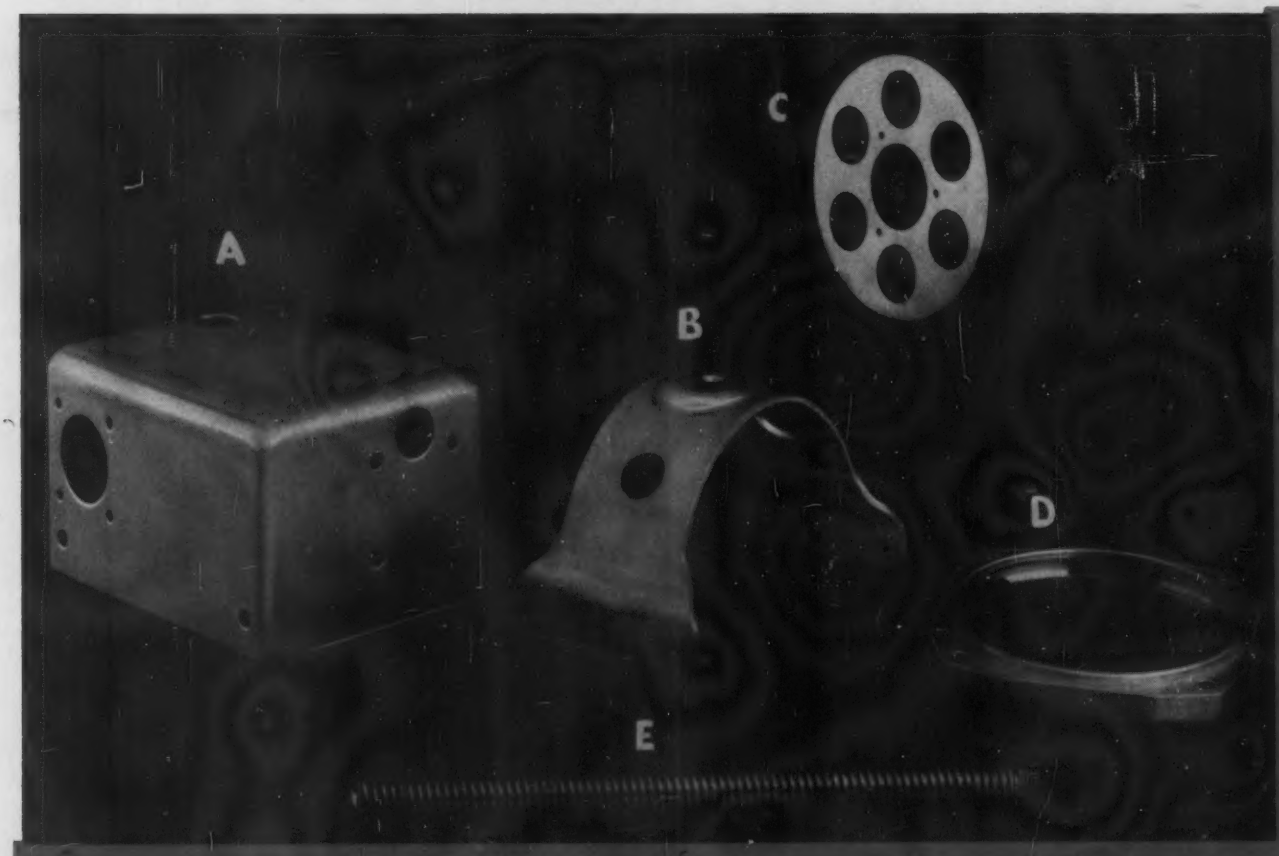
DEPARTMENTS

Typical LEA *Finished Parts*



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b—Bezel for Turn and Bank Indicator
c—Control Block for Actuating Units
d—Averaging Gear for Averagizing Unit
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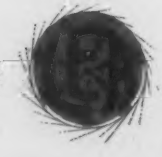
ARMY (E) NAVY



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VOL. 43, NO. 1

METAL FINISHING

JANUARY, 1945

PREPARATION, ELECTROPLATING, COATING

The Bars Are Not Let Down

During the past few months the War Production Board has revoked many orders which controlled the production and distribution of a large number of articles. Such revocations are usually announced as being in keeping with the WPB's policies with regard to reconversion. These policies include the removal of such restrictions as soon as conditions within an industry permit.

Revocation of numerous orders and modification of others affecting the metal working industries, in addition to the abolishment of the Controlled Materials Plan Division, the Conservation Division, and others, may give the impression that the Government is beginning to relax its control over industry. To place faith in such an impression would be practicing self-deception, in our opinion.

The scrapping of article orders and divisions means simply that the WPB is returning to Priority Regulatory control of materials and components which are needed to make the finished articles. The revocation of article orders has not resulted in increased availability of critical materials needed by industry for the production of civilian goods, since the use of such materials is controlled by conservation orders and priority regulations. The revocation of orders and dissolution of divisions may be assumed to reflect the desire of official Washington to streamline its operations and to eliminate unnecessary detail, but not much more.

Critics of the Government have complained that the revocation of orders and dissolution of divisions is practiced to throw dust into the eyes of the public; that such things are often done in order to build up power for some person or groups of persons; that they are sometimes done because they have nothing else to do. One element, however, remains outstanding. Controls have not been removed and production has not been increased to any extent; and the Government has no intention of removing all wartime restrictions with the coming of peace.

Technical Developments of 1944

By NATHANIEL HALL and G. B. HOGABOOM, JR.

Associate Editors—Metal Finishing

Theoretical

THE preoccupation of all technical men with matters of immediate importance to the war effort and with unpublicized projects was reflected, during the past year, in the paucity of published papers in connection with the theoretical aspects of electrodeposition and metal finishing.

Of two papers worthy of note, one, by Wesley and Roehl[1], presented data on *metal distribution* in a Haring-Blum cell which seemed to verify the Gardam equation, employing the nickel chloride, hard nickel and Watts baths. Schaefer and Mohler[2], in the other paper, correlated the *variation of deposit on the inside of eccentric cylinders* with the theoretical current distribution between eccentric cylinders, using internal anodes.

Contrasting with the meagreness of the output on theoretical subjects was the exceptionally large number of patents granted during the year, probably the greatest number ever granted in a single year in the field of metal finishing. This, despite the statements made at various times, that invention decreases during wartime.

Anodizing

The most important development in connection with the anodizing of aluminum during the year was the production of *dyed finishes on oxide coatings formed in the chromic acid bath.* Complete details were offered by Darrin and Tubbs[3] and by Tubbs[4], including anodizing conditions, dyes and dyeing procedures.

Chase[5] described the use of *master racks* in connection with the anodizing of aircraft parts in the chromic acid bath and Goodkin[6], in a generalized but all-inclusive survey, compared the *available methods for anodizing aluminum.* A similar survey, including war and peacetime applications, was presented by Taylor[7].

A number of *new anodizing baths* were patented during the year. Sonnino and Sassetti[8] claimed *a chromic acid solution containing zinc chromate and magnesium chromate.* Brennan and Marsh[9] were the inventors of a *solution consisting of boric acid, ammonia, urea and formaldehyde,* which, though interesting, could hardly be considered practical, in view of the dangerous voltages of 250-500 which are required. *A bath containing aluminate, silicate and caustic soda* was claimed by Frasch[10] while Kraft and Solomon[11] patented a process of *anodizing in a fluosilicic acid solution,* the coating having an iridescent appearance.

Other patents of interest included the use of a *porous diaphragm around the anode* in a sulfuric acid bath, claimed by Farr[12], a method for *stripping oxide films* by immersion in a water solution of sulfuric, phosphoric and chromic acid, patented by Ross[13], and an *anodizing rack* claimed by Nankervis[14].

Two patents were also granted on solutions for *anodizing magnesium alloys* and one for *ferrous alloys.* In connection with the former, Frasch[15] claimed an *alternating current treatment in a chromic acid solution below pH* 2, while Krause and Schroder[16] patented a solution containing an *alkali arsenate, zincate or aluminate.* The patent on anodizing iron was granted to Sears[17] and consisted of the *production of a coating of ferric acetate* in a solution consisting of lead acetate, dioctyl sodium sulfosuccinate and water made slightly alkaline with ammonia.

Courtesy Bendix Aviation Corp.

Corrosion Prevention

Chemical treatments for the prevention of corrosion was the subject of only a few articles but many patents. Platers have been using *thin soap films,* for many years, to prevent tarnish and corrosion but Shoemaker[18] conceived the novel method of adding a *precipitating agent* consisting of aluminum sulfate, sodium carbonate and sodium bicarbonate, in addition to a wetting agent, to an ordinary soap solution. Other organic films patented included the addition to a hydrocarbon oil of *a polycarbolic or monocarbolic acid,* claimed by Jahn[19], a small amount of a *hydrocarbon wax amine* claimed by Anderson[20], *raw beef suet and fat* claimed by Gilbert[21], a petroleum fraction plus *soap and a small amount of an organic amine* specified by Zimmer and Carlson[22] and an aqueous solution of *film-forming hydrophilic colloid and a wetting agent,* claimed by Sowa[23].

Treatment of iron, aluminum, copper and lead as cathode in an oxidizing solution consisting of *chromic acid and potassium permanganate,* a piece of magnesium acting as the anode in a galvanic couple, was the subject of a patent issued to Frasch[24] and an *apparatus for applying rustproofing solutions* by a roller-coating method was patented by Thompson[25].

Among the few technical articles on the subject was a paper by Sorenson and Andrews[26], who investigated the *comparative protection afforded carbon steel aircraft parts* by various treatments such as phosphate and rust preventive oils. Addition to a phosphate solution of an acid in amount sufficient to counteract neutralization by the nitrite present was patented by Gibson[27]. Jernstedt[28] received another patent on his *treatments for phosphating,* the latest one covering a di-alkali metal phosphate solution containing ferric iron.

On the subject of protecting magnesium and its alloys, Close[29] discussed the causes of corrosion and the *processing of magnesium surfaces,* the *methods for treatment* also being discussed in detail by Gruen[30]. Bushrod[31] was granted a patent on a protective treatment in a *manganous sulfate solution,* followed by a solution of an *oxidizing salt.*

Corrosion prevention of cadmium and

was the subject of one article and one ...nt during the year. *The chemistry and ...ation of the dichromate treatments* were ...cribed by Taylor[32] and a patent was ...anted to Hays, Hoover and Taylor[33] on a *...sphate bath for zinc* which applied a ...ing thin enough to be suitable for spot ...ding. A patent was issued to Rath[34] for ...ot caustic dip containing an oxidizing ...ent to make *tin surfaces resistant to ...low" staining.* Pratt[35] found that the *...rosion of stainless steel acid pumps* used ...connection with acid pickling installations ... due to hydrogen evolution from the ...kled steel, which removed the passive ...face from the stainless steel. The passive ... was restored by the addition of 1 g./L. ... sodium dichromate to the pickling ...olution.

Polishing

A year ago, we remarked that, despite the ... of emphasis on appearance since the ...ginning of the war, polishing of metals ...peared to be receiving more than the ...pected amount of attention in the technical ... patent literature. This tendency has ...ntinued through 1944 in undiminished ...olume.

... Lux, in a series of articles[36, 37, 38, 39], dis... all phases of *polishing and buffing* ... *wheel use*, including choice of wheels for dif... purposes, their limitations and con... ...ruction. Eastman[40] outlined the factors ...olved in the *polishing and buffing of die ... castings*, Power[41] described the *composition ... and buffing compounds* and Payne[42] presented ... operating data which proved that *condition... of greaseless abrasive compounds* at ... 70°F. results in a 37 per cent saving in ... material.

... Siefen[43] described an *apparatus for apply... abrasive* to polishing belts to be recoated, ...*olishing wheels* were patented by Malton ... Ball[44] and a *buffing wheel* by Churchill[45]. ... literature on *barrel finishing* of metals ...luded an article by Mitchell[46], detailing ... mechanisms of tumbling, rolling, burring ... ball burnishing action and one by Size... [47], who described the various types of ... *burring processes.* Patents on new types ... *tumbling barrels* were granted to Lupo[48] ... Barnes[49]. Absent from the literature ... any sign of agreement by members of ... industry on the choice of either the cor... term *"burring"* or the commonly used ... incorrect term *"deburring"* in articles ... advertising.

Among the patents on *mechanical polish...* Masse[50] received one on a machine for ...rinding and polishing sheets and new ma... ...hines were also claimed by Hercik[51] and by ...ranwald[52].

In connection with *electrolytic polishing*, ... article by Faust[53] covering the *application ... electropolishing solutions and operating ...ditions* was the only one worth noting ...ing the past year. The patent literature, ...owever, was, as usual, a fertile source of ... material on the subject, the most inter... ...ting, to our mind, being the method of *...oring lost operating efficiency* of used ...sulfuric-phosphoric acid electropolishing solu... ...ions, containing nickel salts dissolved during ... The method, patented by Pray[54], in...

Courtesy Promat Division Poor & Co.

volves heating the bath almost to boiling, cooling and then removing the precipitated nickel sulfate. Beckwith claimed a solution for stainless steel comprised of sulfuric and phosphoric acids plus the addition of *glycine*[55] and also plus the addition of an *alcoholic solution of fluorescein*[56]. Faust was granted patents on a solution for *plain carbon and low alloy steels*, containing sulfuric, chromic and phosphoric acids[57] and on solutions based on phosphoric and chromic acids[58], the latter also being patented for *copper*[59]. An electropolishing process for improving the *reflectivity of aluminum* and its alloys, involving anodizing in a solution of sodium and ammonium carbonate and trisodium phosphate, was patented by Pullen[60].

Cleaning - Degreasing

Anode polarization in electrolytic cleaners based on the more siliceous silicates was found by Liddiard[61], who believed that this is due to build up of silicate ions around the anode, since the film could be wiped off. The author suggested that such silicate cleaners be used only for cleaning without current. The very complete *annotated bibliography of aluminum cleaning*, compiled by Harris and Mears last year, was brought up to date by them with the inclusion of later references and government specifications[62].

Strow[63], in an *evaluation of metal cleaners* discussed the limitations of the various methods and pointed out the possibilities of foaming tests for the determination of cleaner life. *A survey of cleaning and degreasing methods*, in non-technical language was presented by Bialosky[64], the various phases of solvent cleaning and cleaning solutions and equipment were described by Engel[65] and the fundamentals of cleaning of zinc-, aluminum- and magnesium-base die castings were outlined by Mitchell[66].

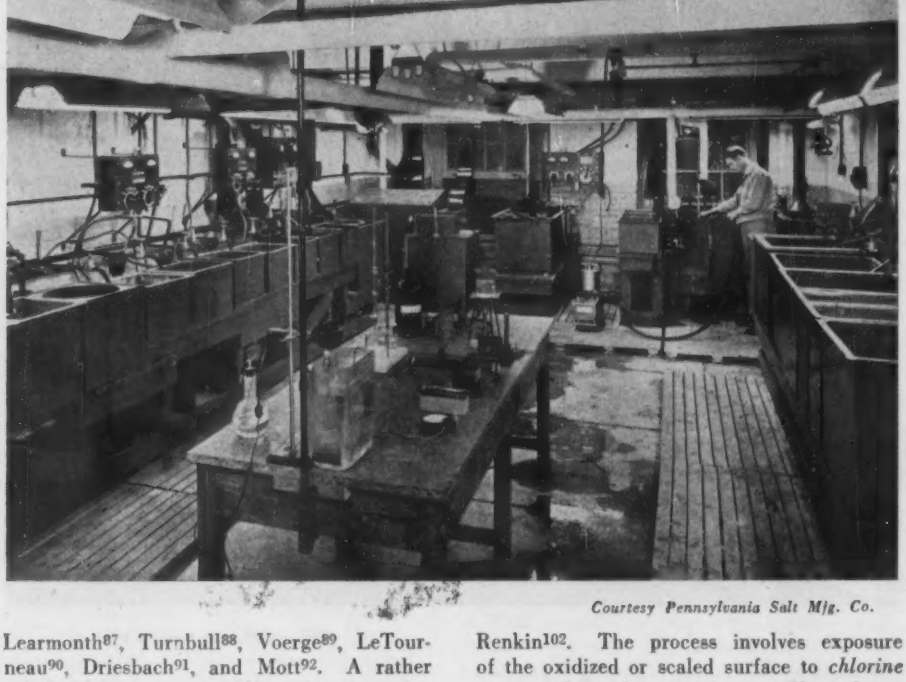
A *cleaning machine* was patented by O'Brien and Strad[67] and *alkaline detergents* for various purposes were the subject of patents granted to Reichert and McNeight[68], Rhodes[69], Schwartz[70], Soderberg[71], Treffler[72] and Comaschi[73]. Precleaning with *solvent emulsions* was the subject of a paper by Lowe[74], who described the types, scope of application, methods of application, testing and the theoretical aspects. Patents were granted on a solvent consisting of *cresol and dibutyl phthalate*, claimed by Backoff and Williams[75], and on a *coal tar oil base solvent*, claimed by Bowman and Packer[76].

Degreasing with *chlorinated solvents* came in for some attention. Practical pointers on *efficient degreaser operation* were listed by Hines[77] and improvements in *degreaser design* were patented by Phillips and Van Fossen[78], and by Heller[79].

Abrasive Cleaning

A most important development in this phase of metal finishing was the discovery by Truden[80] that *sand blasting of stainless steel* promotes corrosion, even when followed by the usual passivation treatments. This may have far-reaching effects in the finishing of stainless steel castings and may result in further development of electrolytic processes as a substitute.

Although the technical literature had very little to offer on this subject during the past year, the field was very well represented in the patent literature. A metallic *abrasive and blasting material* made of iron alloy was patented by Rote[81] and a sand rolling barrel or drum for *cleaning castings* was the subject of a patent granted to Pearl[82]. Improvements in *centrifugal blasting* were claimed in four patents issued to Keefer[83], and in one issued to Foster[84]. Conventional sand and abrasive practice was represented by patents granted to Stearman[85], Crowley[86],



Courtesy Pennsylvania Salt Mfg. Co.

Learmonth[87], Turnbull[88], Voerge[89], LeTourneau[90], Driesbach[91], and Mott[92]. A rather novel idea was a machine for *removing abrasive* from the interior of hollow articles which was invented by Zimmerman[93].

Pickling

A novel twist was given to acid picking by Buente[94]. Finding that, in *pickling of steel strip*, the first part of the pickling period is spent in heating the strip up to the temperature of the pickling solution, while practically no action on the scale is occurring, he substituted a hot water tank for part of the pickling tank length. This, naturally, resulting in a saving in equipment cost, since acid-proof materials of construction are not required for this portion of the line. The action of hydrochloric acid, sulfuric acid and inhibitors in the *pickling of iron and steel* was discussed by Taylor[95] and a patent on the use of *alphatrioxymethylene as an acid pickling inhibitor* was granted to Walker[96]. Other pickling patents involved a *pickling composition* consisting of phosphoric acid, an alkali metal acid phosphate and an alkaki metal bisulfate plus a sulfonated mineral oil, claimed by Morgan and Lowe[97], a *pickling tank lining*, for which a patent was issued to Dean[98] and a method of *neutralizing waste pickle liquors*, involving bringing the pickle and the neutralizing solution together at the intake of a centrifugal pump so that they are violently mixed, without lumping or clotting, during discharge. This latter process was claimed by Carlson and Sharp[99]. Martin[100], in a most unusual patent grant, claimed a method of recovering the metal, which is deposited on the work during the Bullard-Dunn process and then removed in alkali anodically, by using the plated cathode from the alkaline strip as an anode in the pickling bath.

An indication of a possible future trend away from acid pickling may be found in the development of the so-called *"dry pickling" processes*, such as described by Turin[101] and Renkin[102]. The process involves exposure of the oxidized or scaled surface to *chlorine gas at elevated temperatures*. Natural gas burned with hydrogen chloride may be used. Volatile metal chlorides are formed and removed by exhaust fans, and the advantages claimed are absence of acid waste disposal problems, higher speed, elimination of degreasing or cleaning, and, when used prior to hot dip galvanizing, better adhesion and a surface free from blisters.

Cathodic pickling in *fused caustic soda*, another method eliminating acids, was studied by Evans[103], who found the optimum conditions to be 425°C. and 200 amp./sq. ft. or higher. Curiously enough, this method, which is very good for the removal of rust, does not seem to be satisfactory for the removal of thin temper colors, which, as all platers know, can be removed almost instantaneously in hydrochloric acid solutions. Still another "dry" method of pickling is exemplified by the patent issued to Caugherty[104], claiming *removal of scale* by applying a coating of molten glass and cooling and contracting the coated wire until a violent and sudden separation of the glass coating from the wire occurs, the scale being retained with the glass.

Pickling aluminum was covered by one very complete report on *pretreatments for spot welding*, based on laboratory tests and offered by Hess, Wyant and Averbach[105]. Sodium bisulfate and sulfuric acid plus a wetting agent was found to be a very satisfactory pickle and has the advantage of economy. A patent on this subject was also issued to Stevens[106]. Avers[107] was granted a patent on a *pickle for magnesium* and its alloys, comprising a solution of chromic acid and chromic trifluoride, the aforementioned cathodic treatment in fused caustic soda was claimed in a patent by Keene[108] for *removal of light scale from stainless steel*, the treatment being followed by a water quench and immersion in dilute sulfuric acid solution to remove any remaining scale. A *bright dip for stainless steel* was the subject of a pat granted to Mott[109], who claimed a nit hydrofluoric acid solution containing a chl ide of cobalt, nickel, iron, chromium titanium.

Coatings

GENERAL

The *adhesion of very thin electrodepo* was studied by Clarke, Pish and Werg who, by correlating the results obtained X-ray diffraction with measurements of o cal reflectivity, showed that in the ea stages of deposition the substrate metal a very clearly defined influence on the posited metal. The effect was found diminish in a characteristic manner as thickness of deposit increased and three ty of bonding were found, mechanical, s solutions and pseudobasal isomorphism, which the first few atomic layers of the posit follow the crystalline arrangement the basis metal. An explanation for *blistering of electrodeposits on zinc die-castings*, based on a study of the elec chemical behaviour of aluminum, zinc their alloys, was offered by Petrocelli Phillips[111], and *gas caused defects* in elec deposited coatings, such as *embrittlem blistering and pitting*, were examined Zappfe and Faust[112] from the standpoint these defects may be produced by gas issu from the basis metal. These authors show that *"aging" of electrodeposits* is really double phenomenon involving both the p and the basis metal.

A revised and amplified *plating libr* which included books and periodicals presented by Hogaboom[113], Clark[114] descri plastic masks for *plating stop-off* purpose a profusely illustrated article and Leadbe presented a paper on devices for controll *distribution of electrodeposits*[115] with spe reference to building up with nickel chromium. *Salvage of worn or under chined parts* by electrodeposition with ch mium, nickel and iron was discussed Narcus[116]. Among the patents were pla baths based on *hydrocarbon alkyl diamin* such as ethylene diamine, claimed by H ford[117], baths containing an *aromatic sulfo acid*, claimed by Stack[118] and a most unus patent issued to LaMotte[119], for a *deplat rack*.

One patent was granted to Dorfan[120] on apparatus for *heating metal pots* for dipping and one to Finston[121] was on *automatic conveyor*, but *strip, sheet and plating* on a continuous basis received m more attention, patents being granted Baster[122], Ferm[123], Martin[124], Paynter Nachtman[126] and Berquist[127].

Non-electrolytic coating patents were resented by two patents on *metal spray g* claimed by Shepard[128, 129] and by a met involving spraying a metal coating, follo by fusion, granted to Ronay[130]. Other ing methods included *coating of copper faces with a titanium alloy* by appl titanium hydride, followed by heating hydrogen atmosphere to diffuse the tita into the surface, after reduction, on whi patent was issued to Alexander[131], and coating of continuous lengths of strip on side by heating in the presence of a *gas metal carbonyl*, claimed by Drumm

ALLOYS

Optimum conditions and procedures for *deposition of brass* of 70 per cent copper and 30 per cent zinc content were determined by Clarke, Bradshaw and Longhurst[133]. It was found during this investigation that monoethanolamine (B.P. = 170°C.) could be substituted for the usual ammonia addition, with the important advantages that the former can be readily determined analytically and does not evaporate. Another excellent investigation by British workers consisted of the modification of Oplinger's white brass solution by Kronsbein and Smart[134] for the purpose of producing *bright brass deposits* of 70-30 composition at 20 amp./sq. ft. current density with a cathode efficiency of 55-60 per cent. The high zinc content of the deposit was maintained, despite the high current density, by employing a solution containing twice as much zinc as copper.

Deposition of *copper-cobalt alloys* from sulfuric baths was studied by Fink and Hutton[135], who reported that it was not possible to electrodeposit alloys of these two metals, the deposits being substantially copper or cobalt, depending on relatively slight variations in pH, current density, temperature and metal concentration. *Nickel-iron alloy plating* was the subject of a paper presented by DuRose & Pine[136], who claimed that the deposited metal having a composition of 10-30 per cent iron, balance nickel, was silvery-white in color and was better than cadmium, zinc or nickel for protecting steel in moisture laden atmospheres. In the production of *silver-lead-indium-alloy* bearing surfaces, Mullin[137] described the procedures for preparing the surface and the solutions used for each metal, deposited separately and then heated to cause alloying.

CADMIUM-CHROMIUM

Cadmium was the subject of two articles and two patents during the year worthy of mention. Burt and Savage[138] outlined the process used for *aircraft parts* in one of the plants of Douglas Aircraft Co., and the *health hazards* connected with cadmium plating, especially fumes from the heated metal, were reviewed by Neal, Fairhall and Soderberg[139]. A *brightener* for cadmium plating from cyanide solutions, consisting of the decomposition product of the condensation product of sulfamic acid and an aldehyde, was patented by Hendriks[140] and a method of fabricating engine cylinders, which involved cadmium plating on the walls of the cooling jacket, was claimed by VanDeventer[141].

As was to be expected, no attention was paid to decorative chromium plating, all the attention in the literature being focused on industrial or hard chromium. "*Porous*" *chromium* was the subject of some excellent papers, a complete survey of the subject, including *principles and procedures*, winning a prize for Coyle[142], its author. Some superlative photomicrographs were employed to demonstrate the action of porous chromium as a surface for *internal combustion cylinder lubrication*, by Pyles[143]. The photos showed the absorption by the deposited and etched chromium and were taken with both white light and with ultra-violet light. Data, indicating the increased life obtained with *porous chromium plated piston rings* in aircraft engines, were presented by Jarrett and Guerke[144]. As a result of spectrographic and microchemical analyses and by X-ray diffraction studies, it was determined by Cohen[145] that the *network of cracks associated with chromium deposits* contained a chromium compound which is probably a hydrated chromium oxide.

A number of articles on the subject of *chromium plating of tools and dies*, also *chromium plating for salvage*, were published during the year, but only one patent was granted, namely to Lundbye[146], for a *plated doctor blade* for use with printing cylinders. Logozzo[147] listed recommended *cleaning and etching procedures* for the various alloys generally used as a basis for hard chromium deposits, while Howat[148], in a discussion of the *applications of chromium in ordnance manufacture*, described the use of cathode "thieves" and auxiliary anodes in detail. Plating of *chromium on tools, gages, dies, etc.*, as practiced at Delco-Remy Division was the subject of an article by Cotton[149] and the procedures followed at the Springfield plant of Westinghouse were presented by Bennet and Hastie[150]. An interesting statement by the latter authors, to the effect that at 10 or 12 p.p.m. of copper the throwing power of the chromium solution is reduced to zero, warrants checking since this is not in accordance with previous experience.

A novel use for chromium deposits was suggested by Schaffer[151], namely, to prevent *decarburization of tool steel surfaces during hardening*. A deposit 0.0002" thick produced at 131°F. and 1.5-2 amp./sq. in. in the standard bath is sufficient for this purpose. *Salvage* was the subject of articles by Narcus[116] and by Hothersall[152], the *relative advantages of chromium and nickel* for building up mismachined or worn parts being compared.

INDIUM-LEAD-MANGANESE

Data on the *indium plating baths* in commercial use were presented by Murray[153] and Whitehead[154], who also included a number of applications in his paper. Phillips and Linford[155] finally received their patent on the *indium sulfate, low pH bath*, employing soluble anodes in conjunction with insoluble ones. This bath was described some time ago and also in the above-mentioned articles. Elimination of *pores in tin deposits* on copper articles used for handling milk, by indium plating to a thickness of 0.00003" followed by rubbing with a soft cloth to spread it into the pores, was patented by Phillips and Smith[156].

For a while during the past year, it seemed that lead would be the only non-precious metal available for coating purposes, and, this situation gave the Cinderella of coating metals the impetus it required. The present status of *lead coatings*, both hot-dipped and electrodeposited was summarized by Knight[157], while Bray[158] pointed out that hot-dipped lead had the advantage over zinc and tin in lower cost, had a lower melting point than zinc and did not attack the melting pot. It has the disadvantages, however, of softness and inability to form intermediate alloys with iron for strong bonding. The same author also discussed the various *plating baths* used for lead[159], as did Beall[160], who in addition, covered the *characteristics of the deposit*. A process for *hot-dip lead coating* stainless steel wire was patented by Keene[161].

Manganese plating was the subject of an extensive study by Jacobs, Churchward and Knickerbocker[162], the effects of certain variables being determined. The optimum conditions for deposition were found to be 45-50 amp./sq. ft. current density and a temperature of 35°C. Patents included an *insoluble anode* consisting mainly of lead and tin with

Courtesy of the DuPont Company

small amounts of antimony and cobalt, claimed for manganese electrowinning by Mantell[163], and improvements in the *plating bath* on which patents were granted to Ambrose[164] and to Leute, Mantell and Hammerquist[165].

COPPER-NICKEL

Developments in copper plating could be found only in the patent literature during the past year. Wernlund[166] received a patent on a *bright cyanide copper solution*, in which both sodium and potassium ions are present in specified ratios, and containing appreciable amounts of thiocyanate and alkali. A *fused copper bath*, comprising sodium cyanide with a small amount of copper cyanide operated at temperatures not greater than 600°C. was patented by Young[167]. *Copper plating* the outside surfaces of stainless steel cooking utensils was the subject of patents issued to Scavullo[168] and to Kennedy, Knight and Lee[169], the former patent being for a method of plating the outside of a utensil of mild steel, lined with stainless steel, and the latter covering a method of producing adherent coatings of copper to the stainless steel.

It was determined by Martin[170] that *stress in nickel deposits* was probably due to codeposition of hydrates and could be minimized by suitable choice of operating conditions, which were presented in detail. *Cathode potential, efficiency and throwing power* of modern nickel plating solutions were studied by Wesley and Roehl[171], employing the chloride bath, the hard nickel bath and the Watts solution. It was found that the chloride and hard nickel baths had better throwing power than either the high or low pH Watts solution. The different *types of nickel solutions* were discussed by McFarlane[172], who gave their advantages and disadvantages, *nickel deposition for salvage purposes* was the subject of an article by Narcus[173] and the *relative advantages of nickel and chromium* for the same purpose were detailed by Hothersall[152].

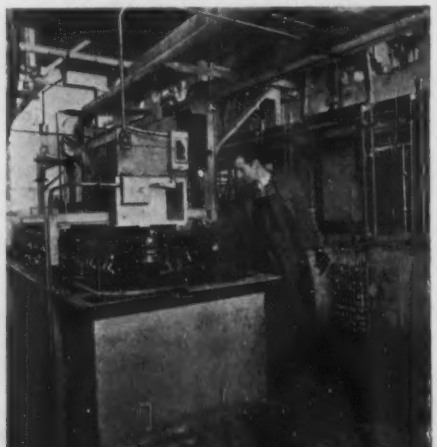
A patent was issued to Pinner[174] on a method of depositing nickel using unbagged *electrolytic sheet anodes* by maintaining the chloride normality and pH values within specified limits. Hogaboom[175] received a patent on a *nickel chloride-acetate* bath suitable for operation at current densities up to 400 amp./sq. ft. *Bright nickel* was the subject of two patents, the addition of small amounts of *selenium* being claimed by Mougey and Wirshing[176], and *pyrimidine* compounds being specified by terHorst[177]. Shepard and Knierim[178] received a patent on the *purification of nickel solutions containing iron*, which involved oxidation with peroxide and addition of a lime slurry to maintain the pH between 3 and 4, in order to precipitate ferric hydroxide. Electroformed *brittle nickel flakes*, suitable for use as a pigment, were claimed in a patent granted to Pilling and Wesley[179].

TIN

In an investigation of tin plating by Hothersall, Hopkins and Evans[180], it was found that the *adhesion of tin*, deposited from an acid bath, was inferior to that from the stannate bath. This was apparently due to *adsorption of gelatin* from the acid tin bath, in which it is used as an addition agent. An alkaline dip before acid tin plating retarded the adsorption of the gelatin.

Electrolytic tin, phosphate and enamel coatings, as substitutes for hot-tinning on can stock were discussed in an article by Luek & Brighton[181]. The authors confirmed what the industry learned in the previous year, namely, that electrolytic tin is not a complete substitute for hot-dipped coatings. *Continuous tin plating lines* were described by Timby[182] and by Reiss[183]. *Removal of excess tin* from hot-dipped sheet by means of flexible rolls was the subject of a patent granted to Keller[184], and a method of removing the excess, by flowing hot oils in contact with the strip but in the opposite direction to the strip travel and at a higher speed, was patented by the same inventor[185].

A method of *flowing electrodeposited tin* on strip by employing zones at different temperatures, while the strip is protected by non-oxidizing fluids, was claimed in a patent issued to Nachtman[186]. Benson and Hoffman[187] received a patent on the *recovery of tin* from tin coated scrap by coating the scrap with caustic alkali and then fusing to convert the tin into alkali metal stannate. Rath[34] claimed a method of preventing formation of "*yellow stain*" on tinned material, involving the application of a hot caustic alkali solution containing a small amount of an oxidizing agent, such as caustic soda and chromic acid.



Courtesy Hanson-Van Winkle-Munning Co.

ZINC

Elimination of the *increase in zinc content* of cyanide zinc plating baths due to chemical action, while the bath is not in use, may be obtained by the application of a countercurrent of about 0.20 amp./sq. ft., according to Hull[188]. A small rectifier is suitable as a current source and will offer a great measure of relief to platers, who have in the past found it necessary to remove all the anodes from their zinc tanks when not in use.

The use of zinc dust for the *removal of copper contamination* from cyanide zinc solutions was studied by Diggin[189]. Where the copper content is above about 0.05 oz./gal. it was found advisable to electrolyze the solution at low current densities until the copper content drops below this figure, at which the addition of zinc dust will bring the copper content down to below 0.0005 oz./gal.

The shortcomings and advantages of *electrogalvanizing* were detailed by Lyons[190]. Sanz discussed the *cleaning, plating and demagnetizing* of large aircraft structures in the zinc tank[191] and *zinc plating for the purpose of lubrication* during drawing and ironing was described by Shepard[192]. Some of the problems encountered in adapting various continuous electrotinning units to strip to zinc plating were outlined by Erbe[193]. Success has been such as to promise the use of the same units for electrodeposition of other metals.

Hot galvanizing came in for its share of attention during the year. Imhoff presented three articles on the subject, including some production phases and determination of *correct temperature and zinc pot capacity*, the *variation in amount of dross, oxide skimmings and sal-ammoniac skimmings* formed by hot galvanizing various articles[195] and evidence to show that, in spite of the theory, small amounts of metals such as *antimony, copper* and *cadmium* are not only not harmful in the hot-galvanizing bath but are of definite benefit[196].

Damaged areas in galvanized coatings can be repaired, according to McBride[197] with an alloy of zinc and tin, containing not less than 8 per cent of the former. The protection given to steel is equivalent to the original zinc coating. *A hot galvanizing zinc alloy*, containing small amounts of lead, cadmium and antimony was patented by Mauk and Ward[198], Dyer[199] prepared steel for galvanizing by *pickling in a solution of ferrous sulfate*, Matteson[200] patented a method of hot galvanizing, in which the molten zinc is maintained over a layer of molten lead through which the sheets are carried before coating in the zinc layer, a process for *galvanizing pipe* was claimed by Ericsson and Mahla[201] and for rods by Moore[202].

Electroforming-Plating Non-Conductors

Electroforming techniques and the *special problems* which arise were described in an extensive article by Savage, Fiandt, Reid and Pfefferle[203]. An interesting section of this paper dealt with the use of *insoluble anodes* and replenishment of the depleted plating solution in *regenerative cells*, using porous diaphragms around the cathodes. Methods of producing *electroformed dispensing tools* and *pulp screen plates* were patented by Wheaton[204] and Orton[205] respectively, and a method of *bonding diamond powder burnishers with metal* was claimed by Seligman, Schwarzkopf and Van Otterloo[208].

On the subject of plastics, Narcus[206] described the various *classes of plastics* and their characteristics, including a general survey of plating on plastics. The first four installments of a complete survey of the subject of *metallizing non-conductors*, by Wein[207] were published during 1944. The articles included metal powders, bonding mediums and production of silver films by chemical reduction.

A large number of patents were granted

during the year, pertaining to metallizing non-conductors. Weiss received a patent[209] on a process for plastics which included *treatment with a solution of water, ethanol, sulfuric acid, quinol and stannous sulfate,* prior to silvering. In the well-known process of applying the silver solution and reducer by means of a spray gun, Tischer[210] claimed the improvement of introducing a *hot reducing gas* into the atomized mixture, while Peacock specified the use of a reducing solution containing *glyoxal*[211]. An apparatus for applying metal films by *thermal evaporation* was patented by Ferguson[212]. Other patents issued during the year included a refinement in the use of *conducting metal powder lacquers,* comprising immersing the coated article in a solution of acetic and pyrogallic acids in water, claimed by Dupuis[213], *radio shielding of plastic spark plug connector bodies* by electroplating, patented by Milton[214], *a ceramic receptacle* with the handle bare and the body electroplated, claimed by Kraft[215] and a conducting *ceramic paint,* consisting of silver powder, basic bismuth nitrate, resinic acid-manganese and resin solution in oil of turpentine, patented by Kollmer[216]. *Equipment for vacuum metallizing* was also patented by Hewlett[217] and by Dorn and Munk[218].

Coloring

Black colors, produced electrolytically in molybdate solutions containing a *polyhydric alcohol and a nickel salt,* was the subject of a patent granted to Schweikher[219], and the production of *rainbow colors by electrodeposition* of oxides of molybdenum from a solution of ammonium molybdate and sodium cyanide was studied by Watts[220].

Two methods for producing a *black color on stainless steel* were presented during the year. A corrosion-resistant oxide film was described by Batcheller[221], produced in a *sulfuric acid bath containing a combination oxidant and etch-inhibiting addition,* and a black, produced by immersion in *molten dichromate* for 15-20 minutes at 730-750°F., was reported by Clingan[222]. *Caustic black finishes* for ferrous alloys were discussed by Black[223], who gave typical formulas and operating conditions, and the use of *an alkaline solution containing a chlorite* as an oxidizing agent was claimed for *coloring copper* and its alloys black in a patent granted to Meyer[224].

Processes have been developed for the production of *dyed finishes on aluminum anodized in the chromic acid bath,* and these processes, involving an increase in anodizing time from 30 to 60 minutes and an increase in operating temperature from 95 to 125°F., were discussed by Darrin and Tubbs[3] and Tubbs[4], mentioned previously. Kraft and Solomon[11] were granted a patent on the production of *iridescent colors on aluminum* by anodizing in a solution of fluosilicic acid of 5-40 per cent concentration.

Testing and Control

A simple titration by which the *aluminum content of chromic acid anodizing baths* could be determined quickly and accurately was presented by Hartford[225]. Miceli and Larson[226] suggested a method for determining the *zinc content of brass plating solutions,* which involved titration with standard ferrocyanide solution, using diphenylbenzidine as an internal indicator and eliminating the effect of ferric ions by the addition of pyrophosphate. Blow, Hiscox and Smith[227] studied the estimation of *ammonia in cyanide plating solutions,* indications being found that, in brass solution control, distinction must be made between free ammonia and total non-cyanide nitrogen, the latter being found only in electrolyzed solutions. Foulke[228] reported that *lead contamination* in plating solutions could be determined colorimetrically with dithizone (diphenylthiocarbazone) and Knapp[229] employed the same reagent for *copper contamination* in nickel solutions, but, whereas the former used an electrophotometer for the colorimetric determination, the latter employed standard color tubes.

Hirsch[230] described the *determination of pH* by the block comparator method using standard acid and alkali with varying amounts of indicator instead of buffer solutions. Since this method has the disadvantage of requiring use of logarithms to obtain the result, it is doubtful whether it will be employed to any extent, but may be studied gainfully by those interested in the why and wherefore of colorimetric comparisons. A *pH meter*[231] and an *electrode assembly*[232] were patented by Cameron.

A *rotating cathode cell* to simulate conditions of high speed strip plating was described by Swalheim[233] for development and control purposes, methods for *measuring thickness* of electrodeposited metals were described by Saltonstall[234] and methods for testing the *tensile and shear strength of the bond* between the basis metal and sprayed metal coatings were presented by Ingam and Wilson[235]. One of the most interesting developments of the year was an *adhesion test* for deposits, developed by Hothersall and Leadbeater[236]. The test involves bombardment of a small spot with a vibrating ball-ended hammer, actuated by a fluctuating electromagnetic field. Small blisters form within about 10 seconds if the deposit is non-adherent.

Aneshansley[237] described the *testing of porosity* of chromium deposits on steel electrolytically, using filter paper dipped in potassium thiocyanate solution and placed between the plated part, as anode, and a sheet of graphite or carbon, as cathode. Red colors appear at the pores. The *design of a humidity cabinet* in which the temperature is maintained by a constant boiling liquid, and in which other variables are also closely controlled was detailed by Todd[238]. Darsey[239] discussed the *control of salt spray chamber conditions* for reproducibility, which is familiar to salt spray operators by its absence, and Larrabee[240] presented a paper on the *effect of specimen position* in the atmospheric corrosion of steel. Corrosion on the upper surfaces of panels exposed at a 30° angle was less than on the lower surfaces, which is the opposite of the effect in the salt spray test.

Miscellaneous

Hall and Hogaboom[241] made their annual *survey of the technical and patent literature,* Eisenbud discussed health hazards in metal finishing departments and their control[242], *ventilation of plating tanks* and a description of different types of exhaust fans were the subject of an article by Artran[243], and *materials of construction* for pickling, cleaning and plating equipment were outlined by Engel[244]. Baechlin[245] presented one of the very few articles ever published on *materials of construction and proper drainage of plating room floors and equipment* with diagrams and photographs, which may well serve as a reference for plant men who, at times, are required to supervise the construction of a plating room floor.

Plastics were *classified* by Narcus[246], together with the characteristics which make them suitable for certain uses in the plating industry. *Insulating and masking materials* of various types, useful for plating purposes, were discussed by Wells[247] and Silman[248] reviewed the *chemical compositions and action of wetting agents,* used in metal finishing processes.

The patents included a variety of developments. An *anode arrangement* consisting of a pan and screen to catch the anode sludge was patented by Keating[249], a *cylinder plating apparatus* was claimed by Coulson[250] and a *complex plating set-up* invented by Olsen[251]. *Plating racks and fixtures* were the subjects of patents granted to Lundbye[252], Strickland and Zemon[253], Kalista[254] for plating the interior surface of a hollow cylinder, Eisenheimer for plating hollow-ware[255], Schneider[256] for a knockdown plating rack, Nankervis[14] for an anodizing rack and LaMotte[119] for a deplating rack.

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(*Continued on page* 20)

The Contribution of Electroplating Directly to the War Effort

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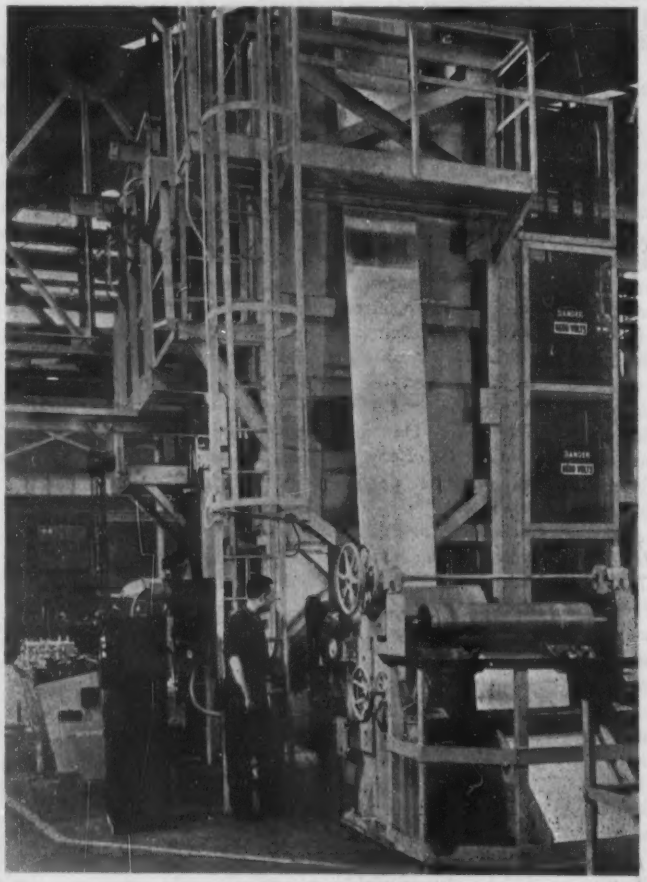
ELECTROPLATING has been engaged in serving the metal finishing industry continuously for well over 100 years, and during the war periods intervening, it has always concentrated every facility on the production of war material and equipment. But the demands of the present war have so far outstripped all previous emergencies as to make them seem trifling by comparison. There is no better method of illustrating this statement than by citing specific instances.

Early in the present emergency, the need for degaussing or anti-mine protection measures became critical for ships afloat. The long experience of plating generator manufacturers with the low voltage, high amperage motor generator sets required was promptly put at the disposal of the Navy Department. After the urgent needs of the Bureau of Ships had been met with emergency shock-proof designs of such standard apparatus that could be readily converted, all ratings were completely re-designed, resulting in most compact high speed, two-bearing units, which have been installed throughout 1943 on a substantial number of the Navy's most important fighting ships.

Commencing with a pilot installation, the Navy Department set up an emergency program for the similar equipment of almost every type of service ship, which included oilers, troop transports, ammunition ships, stores cargo vessels, seaplane tenders, destroyer tenders, stores ships, hospital ships and submarine tenders, to meet which the conventional coupled type of motor-generator set was utilized, the units, however, being of all steel (shock-proof) construction.

For combat vessels a more compact two-bearing set was proposed by one company and accepted by the Bureau for battleships, heavy cruisers, light cruisers, aircraft carriers and carrier escort vessels, besides numerous tenders and repair ships. In the design of these sets the use of castings was largely eliminated in favor of fabricated and welded parts of heavy steel plate. This construction resulted in extreme rigidity and the ability to withstand the shocks of combat to the highest degree. There has been no motor-generator unit returned for failure nor report of such received while in service, up to this writing.



Delivery end of the flow brightener for electrolytic tin plate at Weirton Steel.

Another accomplishment under emergency conditions has been the development of full automatic plating machinery used for the production of naval torpedo parts, such equipment being now in operation at the U. S. Naval Torpedo Stations at Newport, R. I., and at Alexandria, Va. Complete plants are in operation for chromium, cadmium, nickel, tin and copper plating of torpedo parts at the U. S. Naval Ordnance Plants at St. Louis and Chicago.

Despite the fact that they had previously never manufactured such equipment, upon urgent demand also, one manufacturer of electroplating equipment designed and is producing multiple welders for the shipyards.

Full automatic cadmium plating machines are in continuous operation for the processing of steel airplane propeller hubs and adjusta pitch parts which must be plated to rigid Navy specification. T particular problem to be overcome in this instance was to combi the handling in a single unit, of a wide variety of parts, which shar varied in surface area. This was successfully accomplished and s a unit is now in operation at one of the large airplane propeller pla

Anodizing of Army and Navy aircraft production of aluminum a magnesium parts has become one of the most important operations war industries.

Numerous special jobs have also been undertaken. Precis machining and a complex cadmium plating operation on wet g mounts for submarines is one of particular importance because of t necessity of having the cadmium deposit highly resistant to the c rosive effect of sea water.

Prior to the war, it was rec nized that cadmium metal f plating purposes would play important part in war producti processing. The metal was need for plating aircraft parts, na torpedo mechanism, radio pa etc. By close coordination betwe producers of cadmium, the WP and the electroplating industry has been found possible to ma tain prompt scheduling of sh ments of this metal to meet Ar and Navy requirements. Furth continuous thought has been giv to improvements in existing me ods of cadmium plating and a to the use of substitutes for ca mium because of its scarcity.

Following is a short selected l of some of the work in whi electroplating took a primary pa in furthering the war effort.

Aircraft

Chromic acid anodizing of po toon floats.

Chromic acid anodizing and sp cial cleaning of airplane cowlin and special ammunition chut

Chromic acid anodizing of par for amphibian planes.

Chromium plating piston rin for aircraft engines.

Ordnance

Cyanide copper, lead and ca mium plating ammunition.

Cadmium plating time fuse also immersion tin processing.

Cadmium, silver, gold and nick plating various electrical devices for ships and planes.

Miscellaneous

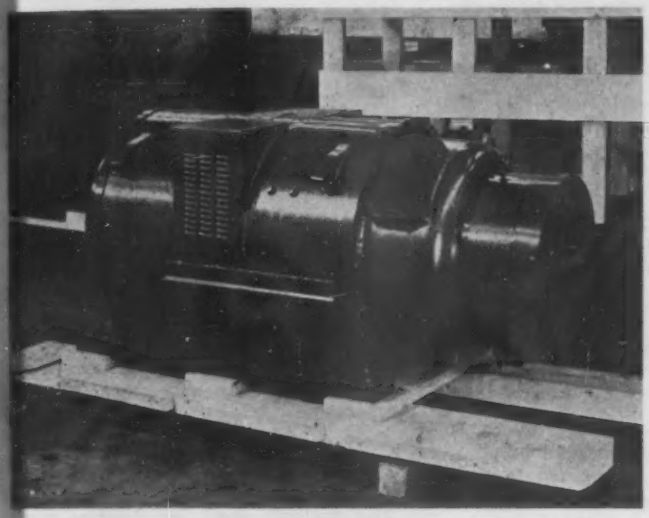
Special motor-generator equipment as Lend-Lease material for o allies.

Electrical and mechanical equipment, motor-generator sets to b used in turning out, in continuous operation, electrolytically tin plate steel strip, saving thereby some 40 percent of the tin as compared wi the previous methods of applying tin to steel strip by hot di operations.

There have been many instances of the assistance to Government Agencies by some of the electroplating equipment manufacture without thought of compensation. For example, one such compa

has collaborated with the War Department Mechanical Time Fuse Committee, at Elmira, N. Y. Their laboratory was offered as a specimen preparation and testing center for studying various protective coatings for malleable iron. Time fuse castings are not satisfactory without protective coatings. Samples were prepared with many different types of finishes and submitted to corrosion tests. This work, extending over a period of several months, was completed with gratifying results.

Certain bearings for aircraft motors require deposits of lead and indium. Such deposits require rigid control by the use of delicate measuring instruments. Full automatic equipment was perfected for such processing, the conveyor arms of this equipment carrying the

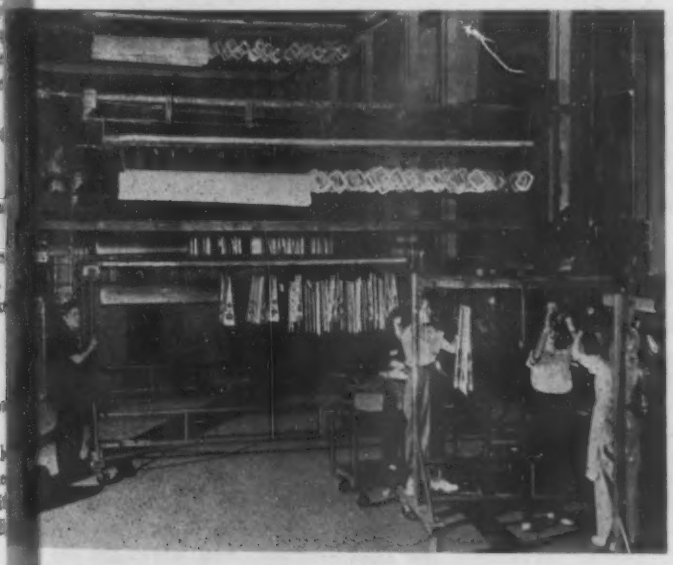


Navy Degaussing Generator Rated at 30 kilowatts.

measuring instruments throughout the processing cycle. Such a unit is in operation at a large aircraft motor plant.

The development and perfection of high speed nickel plating is another contribution to the electroplating industry. It is now being used successfully to build up worn precision parts for Army Ordnance, permitting the grinding and machining of such parts to size with subsequent longer life.

A leading steel mill placed an order with one electroplating equipment maker to design and build equipment for "cladding" steel with nickel and copper for ammunition purposes. On reviewing the plating specifications which were to be used, methods were developed whereby the current density of the nickel plating was increased from an



Loading and unloading end showing 20 ft. carrier on a straight line full automatic cleaning, chromatizing and paint dip conveyor at Bell Aircraft Corp.

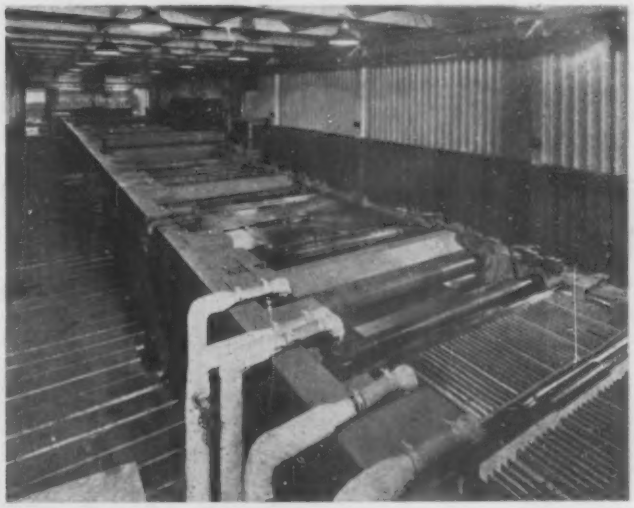
Section of 38" high speed caustic cleaning line showing electrocleaning tank, scrubber unit, hot rinse tank and wringer units at Weirton Steel Corp.

original 10 amp. per sq. ft. of surface area to 150 amp. with almost proportional increase in production. This mill is now producing clad steel billets which are rolled and subsequently forged into shells.

A new line of automatic plating machines was developed for electrodepositing brass on tank tractor blocks and motor supports prior to coating with rubber.

A high speed copper plating process of a cyanide type solution has been perfected which produces close grained deposits now used on precision instruments for the armed forces.

Special alkaline cleaners have been compounded for use by pro-



View looking down on nickel plating tank for plating sheet, showing the dam overflow, contacts and anodes on 60" nickel and zinc plating lines prior to Corronizing installed at Republic Steel Corp. plant.

ducers of cartridge cases, shell cases, etc. Such cleaners are now used by a number of cartridge makers.

Special machinery has been installed to produce circular wire and tampico brushes with a special moisture resistant fibre center. The use of a special stapling device has eliminated the necessity for steel centers with resultant saving of metal. These brushes are used on a wide variety of aircraft products and in the production of electrolytically tin plated steel strip. Complete lines of cloth, leather and felt polishing wheels have been developed for use at Army aircraft field and repair depots on all fronts.

In many quarters it has been the impression that electroplating, although useful, has been only an adjunct to the war effort. The fact is, as borne out by the instances cited above, that electroplating is a direct contributor of no mean proportions to the production of war equipment and materiel.

Metallizing Non-Conductors

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PART V

Silver Sulphide Films

SILVER salts are incorporated in a suitable binder and the work is dipped or sprayed with that mixture, following this, the work is exposed to an atmosphere of hydrogen sulphide which converts the silver salt in the binder to silver sulphide, which is sufficiently conducting to be plated in an acid copper plating bath according to Denorous.

In the silver sulphide method, Hogaboom and Hall recommend either incorporation of silver nitrate in a shellac solution or it can be made to be absorbed on the shellacked surface by immersion in a solution of silver nitrate in alcohol which opens the shellac surface and allows the silver salt to penetrate. The article so treated is then dried and exposed to fumes of hydrogen sulphide until a black film of silver sulphide forms. The hydrogen sulphide is generated conveniently by adding a small amount of acid to liver of sulphur solution or "liquid sulphur" in the bottom of a covered crock in which the article is suspended. Silver sulphide is a conductor of current and the article, after rinsing, can be carried directly into the acid copper plating solution. A formula in which the silver nitrate is incorporated in the shellac solution is as follows:

Alcohol	1 pint
Silver nitrate	1 oz.
Shellac	4 "

This is not used for filling the pores but only as a top coat. For immersing shellacked objects, the solution contains:

Silver nitrate	¼ oz.
Alcohol	2-2/3 fluid oz.
Water	1-1/3 " "

Dimes plates lace by first treating it with a thin shellac solution, allows the solvent to evaporate, thereafter treating it with a silver nitrate solution and subsequently treating it with hydrogen sulphide vapors, after which the washed material is ready for plating.

In the silver sulphide method, another investigator suggests the following shellac solution:

Alcohol	1 gal.
Shellac	3½ lb.
Red lead	½ "

Two or three coats of this shellac solution are generally required, and each coat must be dried in air for about 3 hours.

Plating of flowers, insects and other tissue is difficult because of the nature of the material being handled. With the more delicate objects, it is well to give them greater mechanical rigidity and this can best be done by applying several thin films of shellac. When the alcohol has completely evaporated, the object is then placed in a strong solution of silver nitrate, subsequently transferred to a box, hermetically sealed and into which is passed a steady flow of hydrogen sulphide, forming a film of silver sulphide on the surface of the object, and onto this can be electrolytically deposited copper.

In the case of animal tissue, like the larger bugs, frogs, etc., it is first placed in a solution of:

Mercury bichloride	½ oz.
Water	1 qt.

which destroys the odor and prevents further decay of the object, according to Schore. This is then allowed to dry for at least 24 hours, and subsequently treated as in the above case prior to treatment for plating.

Daly makes a solution of:

Silver nitrate	20%
Potassium sulphide	10 "

To this is added a reducing agent such as oxalic or tannic acid.

Miscellaneous Methods

Both Kushner and Schore suggest dipping the work in a solution of iron nitrate and allowing it to dry; subsequently it is dipped into a silver nitrate solution. This cycle is repeated until a greyish coating of silver forms on the work. This method proved to be unsuccessful, hence, it is not recommended, but it does appear as though some other inorganic reducing agents offer distinct possibilities in this direction.

A slightly modified procedure is to thoroughly dry the work and dip it into ceresin wax at 150 to 160° F. It is then dipped in a solution of:

Silver nitrate	1 oz.
Water	4 "

rinsed, and then dipped in:

Ferric chloride	1 oz.
Water	3 "

The product is then dried in air for a few minutes. The ferric chloride dip must be repeated several times so that the article will completely turn to a silver-grey color. It is then given a final rinse and plated.

Berlandt thoroughly dries a plaster case, then dips it in ceresin wax at about 150° to 160° F. It is then dipped in a dilute alcoholic solution and then washed in distilled water. While still wet, it is dipped in a solution of silver nitrate followed by ferric chloride solution, as above.

Krumholz and Watzek find that iron sulphate may be used as a reducing agent for silver, but in the presence of a trace of a catalyst such as gold in the solution. Thus, the effect of the gold is noticeable when the gold ion concentration is as little as 2×10^{-11}. Halide ions interfere with this effect.

Dimes treats the article with a solution of silver nitrate, which is followed by a solution of phorphorus in carbon disulfide. A typical solution is made up of:

Phosphorus	1 g.
Carbon disulfide	200 cc.

The surface is treated with this compou and allowed to dry in the light, then tran ferred to a solution of:

Silver nitrate	½ o
Water	1 qt.

The article is then rinsed in water and ready to be plated in a cyanide silver solutio

From a historical standpoint, according Kushner, the chemical reduction metho were probably the earliest methods used produce a thin metallic film on non-condu tors for the purpose of plating. Some of th first text books on the subject of platin mention the use of phosphorus in reducin silver from its compounds to form a silv mirror on the object to be plated. The met that is reduced, naturally, does not have be silver, but this metal has been found th most convenient one to use for the purpos Copper can and has been used, but a difficu technique is involved and other metals suc as platinum and gold appear far too cost at the moment to be used this way. The sub ject is one that is deserving of further re search and study.

This method which we describe for it historic importance only is definitely *not recommended one* and is in fact, quite da gerous to use. Essentially, it is this: Th work to be plated is dipped into a solutio of white phosphorus in carbon disulfid (several other solvents almost equally u pleasant or dangerous are also available and permitted to remain in it for a few m ments. The work is then removed and hel over the container of solution until the carbo disulfide evaporates. This is made visible b the smoking of the phosphorus which star to fume the moment the last bit of solve has evaporated. At this moment the work dipped into a specially prepared silver nitra solution. The phosphorus layer on the ob jects causes some silver to be reduced o them and a dark stained mirror of silver produced on the work. This film of silver of sufficient conductivity to permit subs quent plating in an acid copper bath.

As can be imagined, the method is quit dangerous because of the fire hazard involve

Sulphur may be dissolved in oil of lavend till a solution of a common treacle is ob tained. To this is added a solution of metallic salt in ether. The compound form is placed on a water bath and allowed remain therein until the mass assumes th thickness of a heavy paint This is applie to the surface with a brush and subjecte to the heat of a kiln. After it is cool, it ready to be plated. This process is quit simple and may be performed by any plat accustomed to handling chemicals.

Copper Films

Copper films like silver can be deposite on glass, ceramics, plastics and the like m terials, just as in the case of silver hydrazine, etc.

Tartrate Method

About the earliest reference the author could find for forming copper films using Rochelle salts is accredited to Von Liebig. He uses

Copper sulphate	25	parts
Water	100	"

To this he adds:

Rochelle salts	28	parts
Water	28	"

which precipitates the copper tartrate, and to this is added enough ammonia to redissolve the precipitate first formed. Of this solution 1 volume is added to an equal volume of water and applied to the surface of the glass.

A decided improvement over the former process is made by Laval, who recommends the following formulation:

(1)	Silver nitrate	80	g.
	Water	10	oz.
	Alcohol	2	"
	Ammonia	2	"

Allow the precipitate to settle out which should require 3 to 4 hours. Now prepare:

(2)	Silver nitrate	24	g.
	Water	6	oz.
	Copper tartrate	30	g.

Add ammonia, drop by drop, to redissolve the precipitate formed, after which add 2 oz. alcohol. Now prepare:

(3)	Caustic soda	48	g.
	Water	16	oz.

Then add solutions 1 and 2 drop by drop to boiling solution 3 for 1 hour, until a white film is formed on the surface, allow it to cool and filter. Use equal parts of solutions 1 and 2.

Formaldehyde Methods

Dr. Weiskopf appears to be the first to add formaldehyde and the noble metals as a means for "seeding out" the copper onto the given surface. Weiskopf's formula in its original form consisted of:

Solution 1

	Parts
(a) Copper chloride dissolved in water in the ratio of 1:5	100
(b) Platinum or gold chloride dissolved in water in the ratio of 1:10	2
(c) Zinc chloride dissolved in water in the ratio of 1:5	2
(d) Ammonium nitrate dissolved in water in the ratio of 3:100	50
(e) Rochelle salts dissolved in water in the ratio of 1:2	100
(f) Caustic soda dissolved in water in the ratio of 1:10	200

Solution 2

(g) Cane sugar dissolved in water in the ratio of 1:20	2
(h) Glycerine dissolved in water in the ratio of 1:10	1
(i) Formaldehyde (40% solution)	1

Mix 454 parts of solution 1 with 1 part of solution 2. Solution 1, it will be seen, constitutes a modified Fehling's solution. The part that "b" and "c" play is not quite clear, other than to serve as a "seeding" medium. It is found, however, that the formula works less reliably without them. The presence of platinum or gold chloride is very essential. If these are omitted, no useful mirror can be obtained. The copper generally would not settle or precipitate out on the glass, and if it did, the film so formed would be dull and non-reflecting. The addition of the metal chlorides makes the film bright and reflecting. Gold chloride works better than platinum chloride, and provides a warmer and more colorful tone. Besides, the presence of the gold or platinum chloride accelerates the reaction considerably. Some investigators have often attempted to replace these expensive metals by silver, but so far without success, even when copper sulphate was substituted for copper chloride. The silver is too quickly thrown out of the solution by the formaldehyde present, whereas gold or platinum may settle on the glass as invisible crystals giving a basis for the copper to accumulate.

For practical work on a large scale, the foregoing formula had to be varied and simplified. A modern form of this type of copper depositing process may be made up of:

(1)	Copper bichloride	215	g.
	Zinc chloride	16	"
	Gold chloride	4	"
	Water	1750	cc.
(2)	Rochelle salts	735	g.
	Water	1650	cc.
(3)	Caustic soda	355	g.
	Lump sugar	380	"
	Glycerine	325	cc.
	Water	1215	"
(4)	Ammonium nitrate	9	g.
	Formaldehyde (40% sol.)	2100	cc.

To form the copper film take 3 parts of distilled water with 1 part of each of the four solutions just described.

The application of the mixture for coppering is again similar to the process for ordinary silvering. The carefully polished glass is washed with a solution of tin chloride, as usual, or with slightly alkalized water, in order to roughen the surface invisibly and make it fit for the deposition of copper. After washing with distilled water, the glass is covered with the copper solution, either by pouring or preferably by bathing and rocking the glass in the mixture. The copper settles down as a hard layer of metallic copper of a red color which, after careful cleaning with soft leather and distilled water, can be varnished and painted directly or plated with another metal. Often one coat is not enough, and a second coat has to be applied. The temperature must be somewhat above room temperature, about 30° C. (86° F.). The deposition takes about 20 to 30 minutes. The mirror is of a bright and very pleasant appearance, the reflected image being of a distinctly pink color.

A variation of this method deposits copper on glass which has previously been coated with a very thin, completely transparent film of silver. As in this case the base for the copper to settle on is composed of the silver underneath. Gold or platinum can be omitted from the formula, and it can also be simplified in other ways.

One of the least complicated formulas, suggested by Miscatelli, is made up of:

Solution 1

Copper sulphate	4	g.
Rochelle salts	15	"
Caustic soda	9	"
all dissolved in		
Distilled water	1000	cc.

Solution 2

Formaldehyde	200	cc.

For coppering mix solution 2 with solution 1.

As was said before, the glass has to be weakly silvered prior to coppering. The advantages of this method is that it is decidedly cheaper and that different colors varying from pure silver to reddish pink can be produced. On the other hand, it is difficult to obtain the same tone each time and the mirrors are neither so even nor so bright and powerful as those of gold.

All three formulas mentioned contain formaldehyde as the main reducing agent. Formaldehyde has an unpleasant, stinging odor, and smarts the eyes. Further, the reaction develops hydrogen which has a tendency to penetrate through the layer of copper, and results in blistering. It would therefore be highly desirable if the formaldehyde could be replaced by a suitable reducing agent lacking these detrimental properties. However, provided the formulas are carefully balanced, these processes seem to be the best available at the present time.

Neogi's formula for making copper mirrors is similar to that of Dr. Weiskopf.

An anonymous contributor recommends a fresh mixture of 454 parts of a metal solution and 100 parts of a reducing solution. The metal solution consists of:

	Parts
Copper solution (1:5)	100
Platinum chloride (1:10)	2
Zinc chloride (1:5)	2
Ammonium nitrate (3:100)	50
Rochelle salts (1:2)	10
Ammonium hydroxide (1:10)	200

All compounds are dissolved in water in the proportions indicated in parenthesis. The solution must be alkaline in reaction. The reducing solution is made up of:

Cane sugar (1:20)	2
Glycerol (1:10)	1
Formaldehyde (40% solution)	1

The platinum chloride may be partially or entirely replaced by gold chloride. The reduction rarely goes beyond copper oxide if the zinc chloride is omitted.

Noto and Uno reduce Fehling's solution by a 3.5 to 7 per cent formaldehyde solution in the presence of a very small amount of silver nitrate. The Fehling solution is made up of:

Copper sulphate	2	g.
Rochelle salts	4	"
Potassium hydroxide	4	"
Water	100	cc.

The coppering solution suggested by Loiseleur is made of:

Tartaric acid	1.08	g.
Caustic soda	0.9	"
Copper sulphate	3.24	"
Ammonia (20%)	3.0	cc.
Rongalite	0.99	g.
Iron ammonium sulphate	2.93	"
Formaldehyde	0.747	cc.
Water to make	0.36	"

The solution is used at about 25° C.

In the case of coppering cellulose acetate, according to Loiseleur, the following procedure is suggested. The sheet of cellulose acetate is first washed with water, thereafter immersed in a solution of

Quinone	15 g.
Water	1000 "

at 25° for 5 minutes, thereafter washed with running water and then treated with a quarter molar solution of copper oxide in two molar of ammonia at 25° C. This is now treated with a 0.1 molar solution of tin chloride and thereafter immersed in a solution of gold hydrate, and again washed.

Abramson recommends a 9% caustic soda solution, and of it he takes 400 cc. to which is added

100 g./L. sucrose	200	cc.
Water	250	"

which is heated with

Nitric acid	0.5	cc.

until an amber color is developed and adds

Water	1250	cc.
Formaldehyde	80	"

This is added to

Copper sulphate	20	g.
Glycerine	80	cc.
Conc. ammonia	20	"

Place the plastic in it till the copper film is formed thereon.

Hydrazine Methods

Hydrazine hydrate is an organic reducing agent and will precipitate a number of the metals to form films on glass, etc.

Smith forms a strong solution of copper sulphate or acetate, and to this is added a strong solution of hydrazine sulphate when a pale blue precipitate will form, which is decanted and washed, subsequently redissolved in ammonia, forming a dark brown colored solution. Now add slowly a solution of caustic soda until a slight yellow or orange persists after shaking. Redissolve this latter precipitate by using hydrazine sulphate and pour on the warmed glass or other surface, when a copper mirror will be seen to form in a few minutes.

Barnard prepares a 50% hydrazine hydrate solution in water. To this is added, drop by drop and with constant shaking, a 5% solution of copper sulphate until a deep golden suspension of colloidal copper is obtained. One or two drops of excess are added and metallic copper is deposited as a thin film on the surface of the glass.

Herrmann recommends the two stock solutions made up of:

Solution 1

Copper acetate	30 g.
Water	1000 cc.

To the foregoing is added sufficient ammonia till the precipitate just formed is redissolved.

Solution 2

Hydrazine hydrate.....42% solution

This latter solution is commercially available from Eastman Kodak Co.

Mix 10 cc. of solution 1 and 1 cc. of solution 2, pour onto the heated surface (glass) which is at about 90-92°, and, in about 40 to 60 seconds the copper mirror will be seen to be formed. It is now rinsed in running water.

Bamberger and Schweitzer use a relatively weak solution, such as hydrazine sulphate in the place of hydrazine hydrate, because the former is much more soluble in water. This method is made up of the following:

Solution 1

Copper sulphate	50 g.
Conc. ammonia	100 cc.

Thereafter 1,000 cc. of water are added.

Solution 2

Hydrazine sulphate	19 g.
Water	2000 cc.

Solution 3

Caustic soda	20 g.
Water	1000 cc.

For coppering, mix 1 part of solution 1, 2 parts of solution 2 and 1 part of solution 3. Bring the glass into the solution and warm to 70 to 100° for the purpose of acceleration.

French also used hydrazine sulphate during the last war for the production of copper reflectors for use in special searchlights, with quite good results. His solutions were far stronger than that used by the previous investigators, and consisted of:

(1)	Copper hydrate sol. (conc.) in conc. ammonia (.88)	
(2)	Hydrazine sulphate	60 g.
	Distilled water	1000 cc.
(3)	Potassium hydroxide	111 g.
	Distilled water	1000 cc.

Mix 90 cc. of solution 1, while agitating, with 150 cc. of solution 2 which has been warmed to 60° C. Rinse glass, before coppering, with this solution. Add 87.5 cc. of solution 3 at about 60° C. Maintain at a temperature of about 43° C., immerse the glass to be coppered immediately and warm slowly to 57° C.

The solution which was of a clear yellow color in the beginning first turns dark-green, then pink. After about 20 minutes the copper mirror is formed. A second coat can be applied in the same way. The mirror has a pleasant appearance, bright and red.

The method accredited to Chattaway comprises:

Solution 1

Phenyl hydrazine	1 part
Water	2 "

The solution is warmed until it is clear.

Solution 2

Copper hydrate, conc. solution.

This latter is made by dissolving copper sulphate in water, and sufficient ammonia is added until the last trace of precipitate has just about redissolved.

Solution 3

Potassium hydroxide	10 parts
Water	100 "

For coppering, mix 2 parts of solution 1 with 1 part of solution 2 and add solution 3, after being warmed, in such a quantity that a permanent turbidity from precipitated copper monohydrate results. Immerse the glass in the colorless or weakly yellow solution for about 1 hour and warm slowly.

It may be mentioned that preparation of the glass with tin chloride has proved useless in all cases where a relatively high temperature is employed.

Copper Hydride

Huttig and Brodkurt find that if copper hydride (as well as the other metal hydrides) are heated, they are decomposed, leaving a film of copper on the surface on which it has been poured and subjected to elevated temperature. This was later verified by Wagner. The temperature given by these investigators is between 250 to 300° C. This is best accomplished in the presence of hydrogen or illuminating gas.

Copper hydride may be made, according to Vorlander and Meyer, from a solution of [illegible] grams copper sulphate and is reduced with $H_4P_2O_6$, prepared from 100 grams $Na_4P_2O_6$ and 312 grams sulphuric acid (density 1.130). The combined solutions are warmed to 40 to 50° C. The red-brown powder is preserved in a moist state. Copper hydride must not be dried in vacuo and exposed to the air, since it then detonates.

Silver-Copper Alloys

Peacock finds that alloys of silver-copper in the form of mirrors may be formed instead of silver alone on the glass and without the characteristic yellowish cast to it, and, at the same time obviating protection of the alloy, as by means of lacquers, varnishes, etc. This is accomplished in the following formulation.

Solution 1

Into a glass vessel is placed 16 oz. of silver nitrate. To this is now slowly added 11 oz. of ammonia (26°), being stirred to insure complete dissolution of the silver nitrate in the ammonia. When all of the silver nitrate has been dissolved, 16 oz. of distilled water are added, and the solution is cooled and filtered. To the filtered solution is added an additional 144 oz. of water.

Solution 2

Copper sulphate	1 lb.
Water	64 oz.

This latter solution is filtered and kept in a dark bottle until used.

Solution 3

Into a glass container place 64 oz. of water, to which is added 2 lbs. of Rochelle salts. This solution is heated to the boiling point at which time 1 oz. of silver nitrate dissolved in 4 oz. of water is added. The Rochelle salt solution and the silver nitrate solution are then thoroughly mixed together after which the solution is again heated to the boiling point at which time 4 oz. of solution 2 is added, again boiled for at least 10 minutes whereupon it is cooled and filtered. This filtered solution is then placed in a dark bottle in which it is kept ready for use.

Solution 4

Tartaric acid	1 lb.
Water	48 oz.

This solution should be allowed to "age" for at least one week, after which it is filtered. The final solution which is to be used upon the glass surface should be prepared as follows:

Water	64 oz.
Solution 1	2 "
Solution 2	2 "
Solution 3	3 drams
Solution 4	3 "

The technique in preparing the final solution is to mix them in the order given, and that solution 4 is not added until after solution 1 and solution 3 have been thoroughly mixed together. Increasing the amount of solution 4 which is added to the final solution will slow up the precipitation or formation of the silver-copper film on the glass surface.

The surface of the glass to be coated is well brushed with water. Following this water brushing operation, a weak solution of tin chloride is applied to the surface to be treated, preferably by means of a felt block or bristle brush. The surface is then rinsed well with water and lightly brushed.

It takes about 15 minutes before the first coating of silver-copper alloy will have deposited out of the final solution, and upon the glass, and the excess or undeposited solution is removed from the glass surface with a piece of chamois. This latter surface is then brushed to obtain a clean metallic surface for a second coating. The second coating is carried on in the same manner as in the first instance.

A simplified process, according to Miscatelli, is to first deposit a thin film of silver (mirror) onto the given surface, and then treat with:

Solution 1

Copper sulphate	4 g.
Rochelle salts	15 "
Sodium hydroxide	9 "
Water	1000 cc.

Solution 2

Formaldehyde (40% sol.)	200 cc.

To form the copper film, add solution 2 to solution 1. About 15 cc. of a 1% gum Arabic solution may be added to the first solution.

A second modification, according to Miscatelli, consists of the following formulation:

Copper sulphate	3½ g.
Glycerine	4 "
Caustic soda	4 "
Water	1000 cc.

To this latter solution add:

1% Gum Arabic solution	30 cc.

Immediately before applying this solution to the silvered glass surface, add:

Formaldehyde (40% sol.)	100 cc.

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NEW ADJUSTABLE ANODE ROD

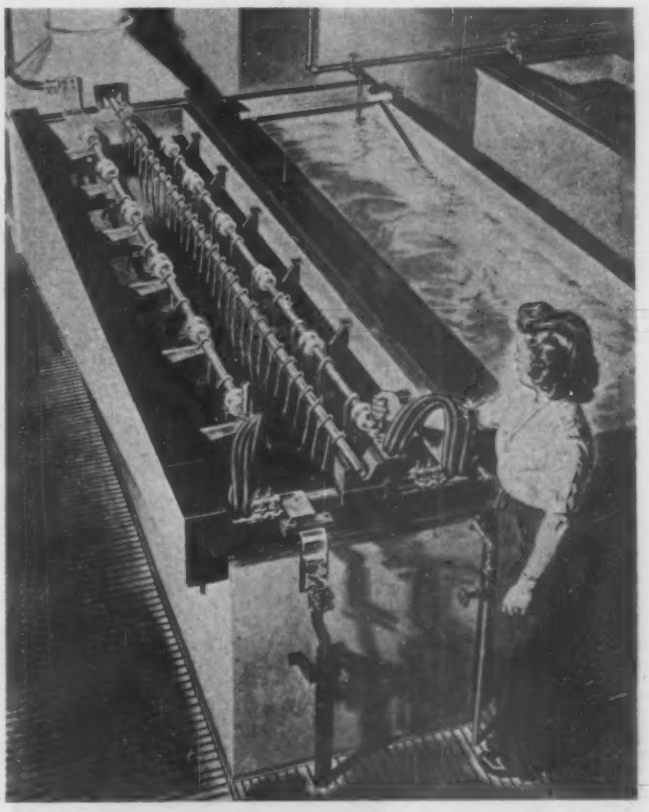
Faster plating of irregularly shaped parts and more uniform and even tempered metal deposits are being achieved in the Finishing and Plating Department of The Glenn L. Martin Company, Baltimore, Md., through the use of a new adjustable anode rod invented by William G. Evans of the Plant and Equipment Department and William C. Shaefer of the Company's Detail Manufacturing Division.

With the new invention it is possible to quickly and conveniently move the anodes to the most advantageous position in relation to the work being plated, thus permitting faster plating of irregularly shaped parts and rapid and positive adjustment to accommodate several types of plating work without electrically disconnecting the anodes from the source of power. At the same time the proper placement of the anodes made possible by this adjustable rod provides a more even disposition and finer texture of the plating material, and reduces the amount of current required.

Designed for use with elongated, mass-production plating tanks, the new installation consists of brackets welded, bolted or riveted to the walls of the tank to which steel plates or arms insulated on either side with phenol fibre are pivotally attached. At the outer end of these plates or arms are swivel fittings on which are mounted annular clamps containing insulators which surround and support the anode rod. The insulators are formed in two halves so that they may be easily installed and clamped in place around the rod. Anode baskets containing chunks or balls of the metal to be deposited are hooked over and supported by the rod.

Current is supplied through a flexible cable attached to one end of the rod, while an insulated handle is provided at the other end to permit the operator to adjust the rod as he sees fit. The rod installation is of sturdy, simple design capable of supporting several hundred pounds of anode material, which can be moved with hardly any effort to any position desired.

In use the operator lowers the work to be plated into the tank, and then by means of the insulated handle, moves the anode rod to place the anodes in the most advantageous position for the parts being plated. When the plating is completed, the rods are moved apart, the plated parts removed, new ones placed in the tank and the adjustment process repeated. It makes little difference whether one batch is similar to another, and the whole adjustment process requires only seconds instead of the long periods of time consumed with previous rod mounting methods. Moreover, at no time during the operation is it necessary to disconnect the rod from the source of power and the lifting of anode material by the operator is completely eliminated.



In The Glenn L. Martin plating rooms the new rod installations are already credited with saving countless man hours, and in addition, have improved the quality of output and cut down on rejections due to coarse textured or uneven coatings.

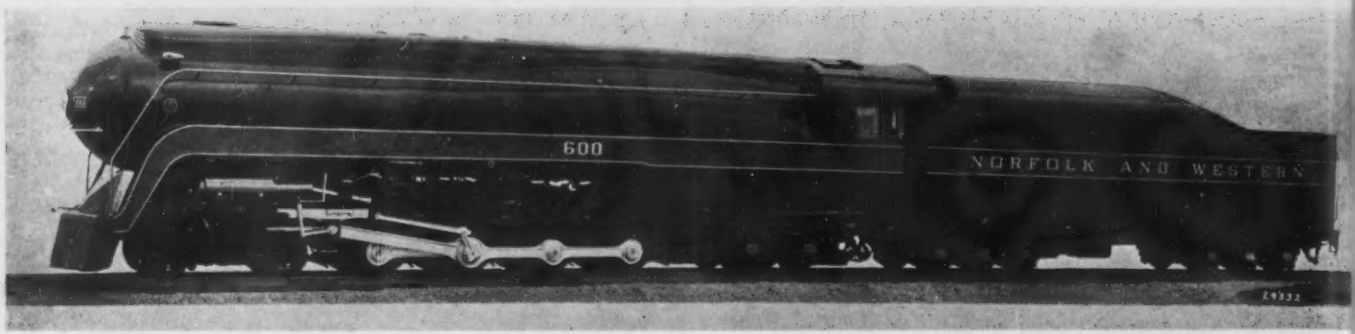
Designs for the adjustable rod will be made available to interested manufacturers of plating equipment under license.

Plating Locomotive and Passenger Equipment Car Parts

By T. R. BOGGESS

Norfolk and Western Railway Company

A pictorial review of electroplating locomotive and passenger equipment car parts, as practiced in the Norfolk and Western Railway Company's Shops located at Roanoke, Virginia

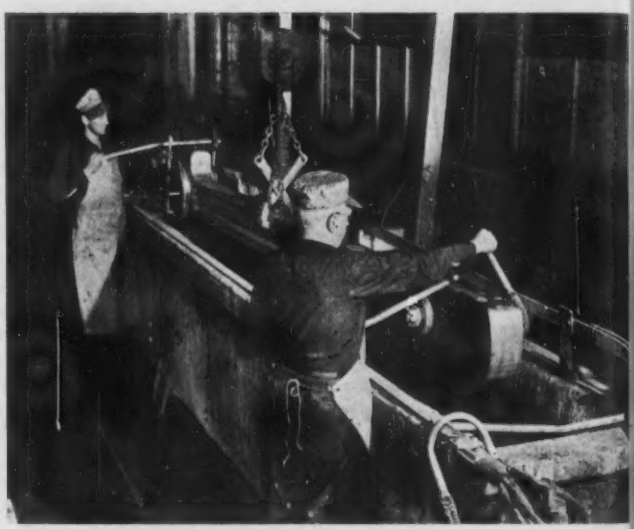


The Class "J" locomotive shown in the photograph above has the following parts electroplated:

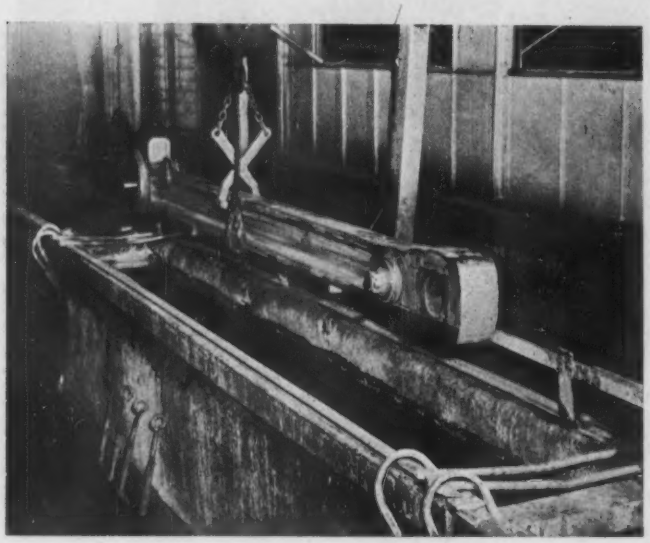
Chromium Plated: Hand rails and brackets, marker lights, number plate frames, gauges, brake valve handles, headlight rims, builder and classification plates.

Zinc Plated: Main rods, parallel rods and parts, crosshead guides, and valve gear parts.

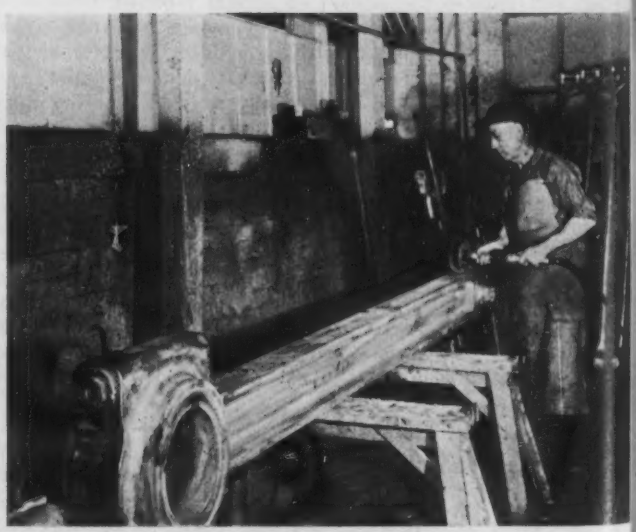
Silver Plated: Headlight reflector.



(Right) Plating a main rod with zinc. The rod is being lowered into the zinc bath for plating after having been sandblasted, cleaned in electro-alkali cleaning bath and rinsed in water. The main rod is suspended in the cyanide zinc solution by copper rods passing through hooks connected to the rod. The copper rods rest on the bus bars on the top edge of the sides of the tank, through which electrical contact is made. These parts are handled by an overhead electric crane. The tank is two feet wide, three feet deep, and sixteen feet long.



Another view of the main rod and plating tanks, showing the zinc anodes hung on copper bars along both of the inside walls of the tank.



The main rod shown in this photograph is being given a light buffing with a wire wheel to obtain a velvet finish. After this operation the rod is ready for re-application to the locomotive. In the right background are shown locomotive valve rods which have been zinc plated.

Locomotive combination lever suspended in a hard chromium solution for the purpose of building up a worn bearing surface. In this particular case the anodes pass through the bearing hole with the remainder of the rod stopped off. When this tank is used for other hard chromium plating the lead anodes are hung from the copper bus bars along the side of the tank. In the background can be seen a voltmeter and rheostat for regulating the current. Vents are constructed in one end and both sides of the tank to exhaust fumes outside the building.

The buffing, polishing and grinding department. Some of the plated parts can be seen on the table, such as passenger car hardware, locomotive locking rings, headlight reflectors, locomotive steam gauges, etc.

(Right) Passenger car window strips being sprayed in the lacquer spray room. At the back are the ovens for drying the lacquered parts. In the left side are passenger car ceiling light fixtures and luggage rack brackets. On the lower right shelf are locomotive steam and air gauges and cap nuts for passenger car luggage racks. On the upper shelf are luggage racks and more gauges.

The tanks shown in this photograph are used in silver plating locomotive headlights. This type of plating was the first done in this shop, about 1900. From left to right: the first tank is the alkali electro-cleaner, the second is a cold water rinse, the third is a hot water rinse tank, the fourth is a round container used for the silver strike solution, and the last tank is for silver plating. The plater is holding a locomotive headlight reflector and is preparing to put it in the tank for plating. The anodes used in this tank are shaped to fit the concave surface of the reflector for even distribution of deposit.

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

Shacat Talks on Porous Chromium Plating

Mr. M. Shacat of United Chromium, Inc., read an excellent paper on "Porous Chromium Plating" to the members of the Baltimore-Washington Branch of the A. E. S. at their December meeting Mr. Shacat said that the war is largely responsible for the rapid development of hard and porous chromium plating. He expressed the belief that porous chromium plating provides better lubricating and load carrying capacity of bearings. After giving a rather elaborate definition of the term porous plating, he outlined the mechanical and chemical processes. This he followed up with a detailed description of the three major steps of the porous chromium plating process, namely: (1) plating; (2) etching, and (3) finishing. He illustrated his paper with slides of chromium plating plants and with many slides of examples of porous chromium plating. For example, he had slides showing the Dubpernell test for cracks; the effect of chemical etching on pin-point, intermediate, and channel porous chromium plating; the effect of prolonged etching; the effect of honing on the finish; the effect of chromic acid concentration on unhoned network pattern size; the effect of temperature, both before and after honing, on network pattern size; the effect of current density on network pattern size; porosity as produced by the simple chemical—hydrochloric acid, etch; porosity as produced by the chromic acid anodic etch; porosity as produced by the cathode etch; the effect of the sulfate ratio on porosity network; a table showing wear machine tests of porous chromium plating of cylinders and piston rings; and a table showing the results of tests of cleaning channel porosity of chromium plated aircraft cylinders after honing.

Baltimore-Washington Branch Plans Big Annual Meeting

President Kenneth Huston of the Baltimore-Washington Branch of the A. E. S. is planning a great annual meeting and dinner for the Branch which will be held at the Maryland Yacht Club, Broening Park, Baltimore, Md., on February 3, 1945. If everything goes according to schedule this annual meeting and dinner will be recorded as the biggest and best in the history of the Branch. The educational portion is scheduled to begin at 4:00 P. M.; the dinner at 7:00 P. M.; the entertainment program at 8:00 P. M., and the dancing at 9:00 P. M. The speakers on the educational program are Dr. Walter R. Meyer, Technical Director of the Enthone Company, New Haven, Conn.; Dr. F. C. Mathers, head of the Chemistry Department of the University of Indiana, and Mr. Adolph Bregman, the well-known consulting engineer of New York City. Dr. Meyer will read a paper on "Chemical Treatments on Copper and Copper Alloy"; Dr. Mathers will present a paper on "The Effects of the Composition of Baths on Deposits," and Mr. Bregman will deliver himself of a paper on "Metal Finishing Costs." The annual meeting and dinner committee consists of Chairman Frank L. Davey of the Egyptian Lacquer Co., Baltimore; Arthur J. Connor of Rheem Research Products, Inc., of Baltimore, and Secretary-Treasurer Raymond Stricklen, Jr., of Turco Products, Inc., Baltimore. President Kenneth Huston will preside at the dinner and he may be persuaded to become master of ceremonies of the entertainment which will be provided by some professionals and by some gifted members of the Branch. The dinner music will be furnished by Clarence Stapleton seated at the combination piano and solovox. The dance music will be provided by the popular and well-known Roby Orchestra of Baltimore. The ladies will not be neglected during the educational portion of the meeting for elaborate preparations are being made for their entertainment.

Consult RFC's Disposing Loan Agency About Surplus Plants and Equipment

In the December number of *Metal Finishing* we gave some information taken from "Advance Listing of Industrial Plants and Plant Sites to be disposed of by Defense Plant Corporation"—a 158-page printed report published by the Surplus War Property Division of the DPC. In consulting this listing it should not be assumed that all such property is at present for sale or lease for the Defense Plant Corporation warns that "negotiations for purchase or lease of the plants and properties listed will be entered into, subject to contingencies of present contracts and length of time plants will continue in war use." To determine if a particular plant or properties are immediately available the interested parties should contact the Surplus War Property Division at the nearest Reconstruction Finance Corporation Disposing Loan Agency.

Surplus Property Disposition Aims and Methods

In the disposition of surplus war property efforts are made (1) to avoid serious dislocations in our national economy; (2) to stimulate employment and production; (3) to attain broad and equitable distribution; (4) to give the small buyers a chance, and (5) to see that the Government gets a fair price. The methods of disposal are (a) auction; (b) sealed bid; (c) negotiation, and (d) fixed price.

War Manpower Commission and Congress Interested In Apprenticeship

The War Manpower Commission is carrying out an elaborate national apprenticeship program which aims to provide war industries and post-war industries with workers who will be the finest in the world. Each apprenticeship course is premised on an inquiry into the probable labor needs of both the industry and the individual plant. All apprenticeship systems require registration with the State Apprentice Council of the individual agreements between the employer and apprentice for the purpose of safeguarding the interests of the apprentice. Senate Bill 1434, which is now before Congress, provides for voluntary apprenticeship in the District of Columbia. This measure aims "to open to young people in the District of Columbia the opportunity to obtain training that will equip them for profitable employment." This bill provides "for a program of voluntary apprenticeship under approved apprenticeship agreements providing facilities for their training and guidance in the arts and crafts of industry and trade, with parallel instruction in related and supplementary education."

Electroplating Apprenticeship Course Started By Art Metal Finishing Co. of Washington

In anticipation of the passage of the Senate bill which provides for voluntary apprenticeship, in the District of Columbia, and in cooperation with the War Manpower Commission, the Art Metal Finishing Co., Inc., has established the first metal finishing apprenticeship courses in Washington. Both the electroplater and the metal buffer and polisher apprenticeship courses are three years in length. The Apprentice-Training Service of the War Manpower Commission determined the employment qualifications, the rules for classification, and the program of instruction. The Art Metal

Finishing Company's apprenticeships provide for theoretical and practical training, for research in new uses and standards of metal finishing, and for an inquiry into improved metal finishing technique. Both apprenticeship courses require a minimum of 144 hours a year, for three years, in related technical and theoretical instruction which will be given by the District of Columbia's vocational education department. In addition to that the apprentice must serve at least 6,000 hours in practical metal finishing work in the shop of the Art Metal Finishing Company under the guidance and instruction of Fred Pierdon or one of his assistants. In the agreement between the apprentice and the Art Metal Finishing Company there is a clause which stipulates the wages the apprentice is to receive during each period of training, which automatically advances at regular and stated intervals as the apprentice's skill and knowledge increase. After meeting all requirements the trainee is given a "Certificate of Completion of Apprenticeship" by the War Manpower Commission to attest that he is a full-fledged craftsman.

Post-War Orders for Materials May Now Be Placed

Interpretation No. 11 to Priorities Regulation No. 1, as amended November 24, 1944, makes it clear that purchase orders may now be placed for materials to be used in post-war production. But, the materials may not be received into a manufacturer's inventory. This is due to the condition that PR No. 1 prohibits persons from receiving more than a minimum practicable working inventory of materials. As a result, deliveries of materials for post-war production may not be received now and orders for such materials must call for delivery at a future time when the materials can be received. It should also be remembered that if the materials or products are subject to restrictions as to placement or acceptance of orders, purchase orders for such materials and products are conditioned by those orders until the restrictions are removed.

Orders Under PR 25 Announced

Direction 1 to Priorities Regulation 25, as amended November 21, 1944, points out that among the orders which come under Regulation 25 are L-5-c Domestic Mechanical Refrigerators; L-13-a Metal Office and Industrial Furniture and Fixtures; L-18-b Domestic Vacuum Cleaners; L-21 Automatic Phonographs, Amusement and Gaming Machines; L-23-b Domestic Electric Ranges; L-27 Vending Machines; L-30-a Galvanized Ware and Nonmetal Coated Metal Articles; L-30-b Enameled Ware; L-30-d Miscellaneous Cooking Utensils and Other Articles; L-37-a Musical Instruments; L-52 Bicycles and Bicycle Parts; L-62 Metal Household Furniture; L-64 Caskets, Shipping Cases, and Burial Vaults; L-65 Electrical Appliances; L-65-a Electric Irons; L-81 Toys and Games; L-140-a Cutlery; L-140-b Flatware and Hollow Ware; L-259 Physical Therapy Equipment; L-39 Fire Protective, Signal and Alarm Equipment; L-29 Metal Signs; M-38 Lead; and M-11-b Zinc.

How to Make Application for Allotments and Preference Ratings On Form WPB-4000

Direction 2 to Priorities Regulation 25, issued on November 21, 1944, provides that application Form WPB-4000 under PR 25 may now be used by a person who wants an allotment of controlled materials, or a preference rating, or both. In other words this Direction makes it clear that a person may now ask for a deferred allotment of controlled materials, or a preference rating of AA-5, or both, by filing Form WPB-4000. Application on Form WPB-4000 may now be used for an allotment or preference rating for any product irrespective if it is a Class A product, Class B product, or an unclassified product. Even though Form WPB-4000 may be used as an application for an allotment or preference rating, like a CMP-4A, CMP-4B, or WPB-2613, the authorization does not give such applicant the right to ignore the restrictions of any WPB regulation or order. If upon making application on Form WPB-4000 the WPB issues a CMPL-150C authorization, that authorization automatically waives any restrictions that are applicable to the product as contained in those WPB orders listed in Direction 1.

Employment Counseling Service Expanded by WMC

The new employment counseling program, developed by the War Manpower Commission headquarters and field staff members with the assistance of an advisory committee composed of representatives of management, labor, veterans' organizations, and vocational guidance organizations, has been expanded in the local offices of the United States Employment Service to assist returning veterans, displaced workers, new workers and other job applicants. The expanded program provides (1) for assisting an applicant to discover, analyze, and evaluate his potential abilities; (2) for providing current information on exact job requirements and employment opportunities; (3) for assisting an applicant to formulate a vocational plan by relating his known and determinable abilities and interests to occupational requirements and to the demand for workers in such occupations, and to assist the applicant to put the plan into effect; (4) for putting an applicant in touch with community facilities, including training, through which he may better equip himself for employment in his chosen field; (5) for discovering and analyzing some of the factors that have prevented an individual from finding work or holding a job in his chosen field and to assist him to overcome these barriers to employment, and (6) for assisting an applicant in locating a suitable job.

Priorities Regulation No. 24 May Be Changed Soon

Priorities Regulation No. 24 is the subject of some discussion these days in Washington. At the present writing it appears that the regulation may be revoked, or Class A List will be eliminated about the middle of January, 1945.

The Pin Situation and Plating Materials

At the December meeting of the Common and Safety Pin Manufacturers Industry Advisory Committee it was learned that enough safety pins are being made to meet essential requirements, but that the number of common pins were slightly below minimum requirements. WPB representatives said that the outlook for production of solid brass pins is unfavorable even though the WPB did permit the industry to resume the use of brass. They pointed out that scrap copper is obtainable for use in *brass plating* steel pins. Copper order M-9-c, as amended, permits pins to be *brass plated* provided this is necessary for utilitarian purposes. The members said that steel pins, plated with brass, and finished with an overcoating of tin or nickel were made in large quantities before the war. The Committee members said that *brass plating* probably "would not be necessary unless tin or other metals are available for overcoating." The WPB officials present said that as a result of appeals granted under Tin Order M-43 some manufacturers have been authorized to use tin for *plating* pins. They pointed out, however, that these authorizations were to be cancelled on December 31, 1944. Therefore, unless pin manufacturers file new appeals under the order, and the WPB approves such appeals, no *tin plated* pins may be made. The WPB representatives revealed that increased military requirements has resulted in a severe tightening of the supply of nickel anodes and salts for plating. They said that the prospects for the resumption of the use of nickel for pins are extremely remote. Members of the committee reported that the shortage of sodium cyanide which is needed for zinc plating is impeding production. They said that potassium cyanide can be substituted for sodium cyanide, but this necessitates a complete change in formula and the use of different ingredients in the plating solution.

A Bird's Eye View of the Future As Seen By Washington Crystal Gazers

Some of the crystal gazers of Washington are of the opinion that there will be a falling off of zinc plating after the war. They are also of the opinion that there will be a reasonably steady, perhaps increasing, demand for hard chromium plating. Some of the over-equipped plants which were expanded for war purposes, they believe, will have some highly depreciated equipment on their hands. They also recognize that there will be an increasing amount of plating on plastics, glass and other products.

Safety Engineering Education Placed On Permanent Basis To consolidate the gains in industrial safety engineering education under the war program of the United States Department of Labor, twenty-five colleges of engineering have decided to grant safety engineering a permanent place in their curricula. In commenting on this Secretary of Labor Frances Perkins said: "The cooperating colleges are basing their plans upon a program devised by the National Committee on Safety Engineering Education in Colleges, a development of the Department of Labor's emergency safety program. They are being assisted by staff safety consultants of the department. The immediate objective is the integration of safety into undergraduate curricula, so that future engineering graduates will be grounded in the fundamentals of safety and take into account operating hazards in designing machines or laying out production processes. At a later date some engineering schools will establish safety extension courses, similar to those offered under the war program, and a selected number will institute special postgraduate courses."

Check List for the Introduction of New Consumer Products The Department of Commerce's Bureau of Foreign and Domestic Commerce recently released a booklet entitled "Check List for the Introduction of New Consumer Products" which was prepared by a committee of experts and reviewed and revised by the Chicago Chapter of the American Marketing Association. This booklet was prepared as a working tool for manufacturers who want to make sure they have thought through their merchandising and selling problems before they launch a new product on the market. It is not a textbook; instead it is a series of six worksheets with introductory text and summary lists. This booklet which may be obtained free upon request from the Department of Commerce, Washington 25, D. C., or any of the Department's field offices, deals with such subjects as (1) The Users of the Product; (2) Channels of Distribution; (3) Competition; (4) Manufacturer's Price Policy; (5) Selling and Promotion, and (6) Legal and Related Problems.

A Community Service for Small Businessmen Suggested It is the contention of Mr. D'Alton B. Myers of the Department of Commerce's Division of Small Business that many small businesses would be glad to turn over to a service company the task of taking care of their bookkeeping, accounting statements, tax records, inventory taking, and training and checking on their sales staff. He also recommends that outlets for small businesses could be developed by finding profitable uses for idle equipment.

MRO Symbol Usage Widened Controlled Materials Plan Regulation No. 5, Direction No. 24, which was amended on November 18, 1944, provides that all persons who are eligible to use the AA-1 preference rating according to the terms of CMP 5 for their MRO supplies may now use the MRO symbol.

$21,000,000,000 In War Contracts Cancelled Up to early November, 1944, about 37,000 prime contracts had been cancelled by the Maritime Commission, Navy Department and War Department. These contracts total about $21,000,000,000. During the first seven months of 1944 the War Department cancelled contracts with an unfilled value of about $5,000,000,000 and up to November they had already made settlements which exceeded $4,000,000,000.

Aluminum May Be Tightened Early In 1945 War Production Board officials told members of the Aluminum Industry Advisory Committee at their December meeting that resurgent war demands in the first six months of 1945 might cause a tightening of aluminum products. It was pointed out by these officials that this is due to a shortage of manpower in the fabricating plants rather than in the supply of aluminum.

Buff and Polishing Wheel Committee of the OPA The Office of Price Administration, on November 27, 1944, appointed a Buff and Polishing Wheel Industry Advisory Committee. The members of the committee are E. W. Hall of F. L. & J. C. Codman Co., Rockland, Mass.; Charles W. Gore, New England Buff Co., Boston, Mass.; B. D. Divine, Divine Brothers Co., Utica, N. Y.; Lewis Goodman, Midwest Buff Mfg. Co., Cleveland, Ohio; M. I. Doyle, Parker Brothers, Inc., Brooklyn, N. Y.; A. S. Yohe, The Bias Buff and Wheel Co., Jersey City, N. J.; L. W. MacFarland, MacFarland Mfg. Co., Long Island City, N. Y.; George O'Connell, Advance Polishing Wheels, Inc., Chicago, Ill., and Ben P. Sax, American Buff Co., Chicago, Ill.

Building Alterations Rules When Installing Machinery On December 2, 1944, the WPB issued Interpretation 11 to Conservation Order L-41 to clarify the provisions governing building alterations that may be made in connection with the installations of machinery or equipment as permitted under Direction No. 2 of the Order. The Interpretation states that alterations can be made without WPB permission only if they are directly required in connection with the installation or operation of the machinery or equipment being installed. Alterations not directly required in connection with the installation or operation may not be made under the Direction. The Interpretation points out that the Direction does not limit the cost of building materials which may be used in connection with the installation of machinery or equipment to be used in a business designated on List A of Controlled Materials Plan Regulation No. 5; on Schedule I or II of CMP Regulation No. 5A; or in a business given priorities assistance by any P or U order for maintenance, repair or operating supplies. Service or processing machinery or equipment may be installed in an existing building regardless of how the equipment is obtained.

Cadmium Plating Now Permitted On Threaded Fittings General Preference Order M-65, as amended November 21, 1944, provides that cadmium chemicals may now be sold by manufacturers without the necessity of the purchaser certifying to its use. The amended order permits one new use of cadmium—the plating of threaded fittings of gray and malleable iron one-half inch or less in size.

Electrical Appliance Industry Is Thinking of the Future At the December meeting of the Electrical Appliance Advisory Committee the members recommended that the WPB allow their industry to order in advance, on AA-3 ratings, material needed for civilian production after the defeat of Germany. WPB officials suggest that the industry take advantage of regulations designed to aid manufacturers in their preparation for reconversion such as PR 23 which authorizes the development of experimental models, and PR 25 which authorizes the taking of unrated orders for machine tools for future delivery. And in regard to PR 25 IAC members recommended that future authorizations, although granted by regional WPB offices, should be specifically approved by Washington.

Galvanized Ware Situation Is Serious War Production Board representatives told the members of the Galvanized Ware Manufacturers Industry Advisory Committee at their November meeting that the requirements for galvanized sheets have reached an all-time high. Due to a manpower shortage, production cannot be increased to meet the demands. WPB officials said they could not guarantee that galvanized ware manufacturers will be able to get delivery of galvanized sheets to meet their current and 1945 quarterly allotments. It was brought out at this meeting that galvanized ware manufacturers were working with a day to day supply of material. This is a hardship since at least a thirty day balanced inventory is necessary for efficient operation.

TECHNICAL DEVELOPMENTS

(*Continued from page* 7)

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198. A. J. Mauger & A. H. Ward. U. S. P 2,360,784 (Oct. 17, 1944).
199. C. P. Dyer. U. S. Pat. 2,353,019 (July 4, 19
200. E. A. Matteson. U. S. Pat. 2,345,058 (M 28, 1944).
201. K. A. Ericsson & W. T. Mahla. U. S. P 2,356,739 (Aug. 29, 1944).
202. A. S. Moore. U. S. Pat. 2,357,439 (Sept 1944).
203. F. K. Savage, R. M. Fiandt, D. B. Rei P. R. Pfefferle. Proc. Amer. Electropl. S p. 173 (1944).
204. E. O. Wheaton. U. S. Pat. 2,351,568 (J 13, 1944).

(*Continued on page* 37)

Patents

Chromium Plating

U. S. Pat. 2,361,554. A. E. Lundbye, assignor to The Crowell-Collier Publishing Co., Oct. 31, 1944. The method of making a doctor blade for use with printing cylinders, which includes the flash plating with chromium of a relatively thin steel blade having a thin forward edge adapted to engage the surface of a printing cylinder, the thickness of the chromium being from one ten thousandth (.0001") of an inch to fourteen hundred thousandths (.00014") of an inch in thickness, and extending substantially an inch and a half rearward from said forward edge of the blade, heat treating the blade in oil at a temperature of approximately four hundred fifty degrees Fahrenheit (450° F.) for from one to three hours, cooling the blade in the oil to approximately one hundred degrees Fahrenheit (100° F.), then down to room temperature, removing the blade and grinding the forward edge to remove the chromium plate from said forward edge.

Metal Cladding

U. S. Pat. 2,361,962. B. Ronay, Nov. 7, 1944. In a method of metal-cladding a metal surface, spraying a clad-metal in the desired thickness on the metal surface, applying a suitable deoxidizer by painting, then preheating the entire combination and then progressively remelting the metal coating by means of applied heat sufficiently concentrated to fuse the coating to the surface of the metal without dwelling long enough in one place to cause a metallurgical change in the base metal or to disturb the original contour and thickness of the coating.

Degreasing Apparatus

U. S. Pat. 2,362,155. W. D. Phillips and R. A. Van Fossen, Nov. 7, 1944. In a portable degreasing apparatus, comprising a chest having a condenser mounted adjacent its inner rim, a vapor generator in the bottom, and a vapor treating chamber between the generator and condenser; the combination with a tumbling apparatus comprising a frame consisting of a pair of spaced apart rails interconnected by cross beams and adapted to be positioned at an incline within the vapor chamber with the lower end below the vapor level; a tumbling basket consisting of a foraminated cylinder, a handle mounted on said cylindrical basket, the arrangement being such that the cylindrical basket may roll down the inclined rails to enter the degreasing vapor chamber and roll upwardly along said rails as the cylindrical basket is removed from the vapor chamber to effect repeated tumbling of the contents of said basket.

Blasting Abrasive

U. S. Pat. 2,362,310. F. B. Rote, assignor to The International Nickel Co., Inc., Nov. 7, 1944. Metallic abrasive and blasting material made of substantially spherical cast iron particles having a microstructure comprised substantially entirely of carbide and austenite, and containing about 2% to 4% carbon, 0.2% to 1.5% manganese, 0.2% to 1% silicon, 0.5% to 6% nickel and the balance substantially all iron.

Plating Hollow-Ware

U. S. Pat. 2,362,474. C. W. Eisenheimer, assignor to Manning, Bowman & Co., Nov. 14, 1944. An apparatus for electroplating an article of hollow-ware comprising an electrolytic bath, a frame adapted to be lowered into and lifted from the bath, support means for the hollow-ware mounted on said frame and pivotable with respect thereto, and means responsive to the immersion of said frame into the electrolytic bath for adjusting said support means to a position to support the article in upright position when within the bath and responsive to removal from the bath for adjusting the support means to a position to support the article in inverted position.

Plating Fixture

U. S. Pat. 2,363,005. G. Kalista, Nov. 21, 1944. A fixture for plating the interior surface of a hollow cylinder having a radially depending bracket, said fixture comprising a metallic plate connected to the negative terminal of the electroplating current, a rod-like anode having one end secured to said plate but insulated therefrom, a spacer on the other end of the anode engaging the interior surface of the cylinder said spacer being formed of insulating material and having apertures therethrough to permit the flow of electrolyte through said cylinder, a stud mounted on said plate in fixed relation to said anode, said stud being conductively connected to said plate and means on said stud adapted to conductively engage said bracket to hold said cylinder on said stud and in concentric relation with respect to said anode.

Metallizing Non-Conductors

U. S. Pat. 2,363,354. W. Peacock, assignor, by mesne assignment, to Libbey-Owens-Ford Glass Co., Nov. 21, 1944. A method of coating a surface with a film of metallic silver having a high coefficient of reflection which comprises preparing and maintaining in separated relation separate solutions of silver ammonio nitrate and a reducing agent therefor, in simultaneously introducing approximately equal quantities of said solution into a jet of compressed air, said solutions being entrained in said jet in the immediate vicinity of its discharge into atmosphere whereby said solutions are atomized and intimately mixed together for reaction to produce metallic silver which is adapted to be applied in the form of a homogeneous film over the surface to be covered, said reducing solution containing glyoxal and directing the mixture thus formed against the surface to be covered.

Polishing Machine

U. S. Pat. 2,363,728. R. Grunwald. Nov. 28, 1944. The combination in a polishing machine comprising a driving pulley, an adjustably positioned polishing head aligned with and spaced from said driving pulley and comprising a bed plate provided with slideways, a carriage supported on said slideways, a belt supporting plate having a rounded edge arranged to engage one loop end of endless polishing belt, said plate extending longitudinally within said belt and being spaced from said carriage, support means said carriage supporting said belt plate one end.

Metal Evaporation

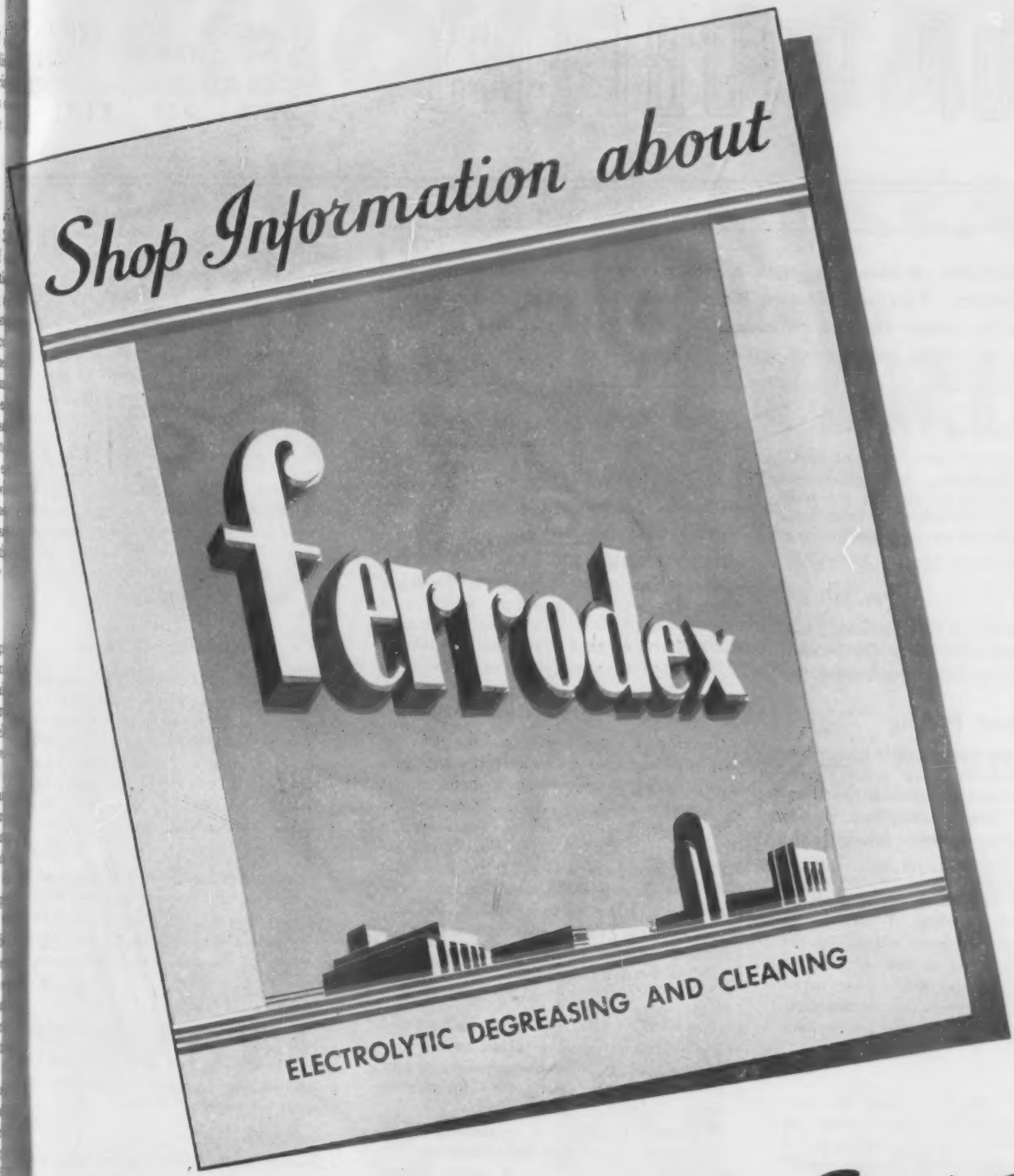
U. S. Pat. 2,363,781. L. Ferguson, signor to Bell Telephone Labs, Inc., Nov. 1944. Apparatus for coating a surface of object with aluminum by thermal evaporati comprising a vessel, means for exhausting from said vessel, a rectangular tungs heater element having a substantially c tinuous outer surface, said heater elem having an inner chamber, a supply of alu num in said inner chamber, means for he ing said heater element, a table within vessel for supporting said object to be coat and means for supporting said heater ment within said vessel above said table w one of the two larger sides of said elem substantially parallel to said table with one side closer thereto than any of the ot sides of said heater element.

Abrasive Blasting

U. S. Pat. 2,364,077. W. L. Keefer, assig to Pangborn Corp., Dec. 5, 1944. In abr ing apparatus, a rotor including a plura of propeller blades terminating inwar short of the axis of the rotor, an impe rotatable with said rotor arranged betw the inner ends of said propeller blades cluding a plurality of radially arranged va having free lateral edges, a stationary a ate shaped guard having a circumferen length of less than one-half the circum ence of the impeller mounted between path described by the inner ends of said peller blades and the path described by outer ends of said impeller vanes, and a spout terminating adjacent the free lat edges of said impeller vanes having a charge opening in the terminal end loc within a sector defined by the circumfe tial ends of said guard and at a posi radially displaced from the axis of the peller for supplying abrasive axially the free lateral edges of the impeller v and onto outer end portions of the impe vanes whereby the abrasive is discha from the impeller vanes adjacent an en said guard.

Plating Fixture

U. S. Pat. 2,364,564. R. L. Strickland H. Zemon, assignors to Detroit Aluminu Brass Corp., Dec. 5, 1944. Apparatus electroplating the inside and outside tube simultaneously comprising a tube port and an anode assembly, the tube sup being of a character to leave exposed surfaces of the tube to be plated, the a assembly consisting of a body whose l end is adapted to be disposed within upper end of the tube, and supplemen elements secured at the upper end onl said body at a point above the tube adapted to be disposed around the u end of the tube outside of it, the a assembly moving as a unit during the tioning of the tube and the anode asse for plating.



Send For

THIS NEW BOOKLET
EXPLAINING THE USE OF FERRODEX
AND OUR EXCELLENT KEMTEX CLEANING COMPOUNDS

ADDRESS A NOTE ON YOUR LETTERHEAD TO W. D. MacDERMID CHEMICAL CO., DEPT. K, BRISTOL, CONN.

W. D. MacDERMID *Chemical Company*
BRISTOL, CONNECTICUT

SHOP PROBLEMS

PLATING AND FINIS
POLISHING — BUF
CLEANING — PICK
HOT DIP FINIS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Electropolishing Tool Steels

Question: We have recently become interested in electropolishing high-speed tool steels, and are wondering whether you have any information on this subject in your back issues of *Metal Finishing* and whether you could advise us where we can obtain any information.

N. E. Co.

Answer: A section on electropolishing will be found on pages 50-59 of the 1944 edition of the PLATING AND FINISHING GUIDEBOOK.

Silver Plating

Question: We are starting to do some silver plating which is entirely new to us. I have tried a small amount of solution mixed up from the Woods' silver plating bath that is given in your last manual, also with the strike solution.

I seem to get a good plate but the brightener does not seem to have much affect on the appearance of the plate. I have put in up to ¼ ounce of brightener mixed with the strike solution per gallon and I added it gradually but there did not appear to be much change in the appearance of the plate.

Would you please give me any information you can on this?

V. B.

Answer: You must not expect the same brightening action as you would obtain by adding a brightener to a nickel solution. A silver solution containing brightener should deposit a slightly cloudy plate with a dull gloss.

Polishing Engine Parts

Question: Can you please give me information on the polishing of airplane engine parts, as our inspection insists that polished parts are stronger than parts not polished? Any information will be appreciated.

M. H. R.

Answer: Polishing will remove surface cracks and defects which act as focal points for incipient failure.

Thickness Measurements

Question: I read with great interest the article by R. B. Saltonstall on page 606 of the October issue, entitled "Thickness Measurements of Electrodeposited Metals."

We barrel plate our product, which averages about ¼ inch in diameter and ⅜ inch in length. Cadmium, tin, and copper plate is tested by us by the Hull & Strausser drop method. Is there a similar standardized method for the thickness of silver plate and nickel plate?

T. R. & S. Co.

Answer: Solutions have been developed using the jet test apparatus, which is a modification of the dropping test, and details will be found on page 153 of the 1944 edition of the PLATING AND FINISHING GUIDEBOOK.

Plating on Bronze and Brass

Question: I would appreciate any information you may give me concerning the gold plating of an article which is made of flat stock bronze and brass about 1/16 inch thick. This article is silver soldered, but in places it is lead soldered, this is what gives me trouble. Successfully coating the lead with nickel or copper, also silver has not been satisfactory. When scratch-brushed, the lead shows through. I have even tried a tin plate (electro). Much of this work has to be plated with an inside anode.

H. H. B.

Answer: The parts should be cleaned in a suitable alkaline cleaner taking care not to overclean. If the parts are very dirty or oily, a solvent should be used before the alkaline cleaner.

The article should then be rinsed, dipped in a mixture of one part hydrochloric acid to three parts of water, rinsed again, dipped in a sodium cyanide solution, and copper flashed.

The article may then be nickel, silver or gold plated.

Disposal of Waste Products

Question: We are interested in obtaining some mechanical equipment for the treatment of cyanide solution, also acid solution before disposal into the sewerage system.

Can you furnish us the names of any companies who manufacture such equipment?

U. S. T. CORP.

Answer: A list of manufacturers of equipment for this purpose will be found in the "Chemical Engineering Catalog" under the heading of "Recovery, Treatment or Disposal of Waste Products." If you are unable to reach a copy of this catalog, two of the well known manufacturers are Chemical Construction Company, 30 Rockefeller Plaz Dorr Company, Incorporated, 570 Lexi Ave., both of New York City.

Anodizing

Question: Would you please, at your est possible convenience, send us some ture on sulphuric acid anodizing and any literature you may have on ano over zinc chromate primer?

F. L

Answer: We do not have any inform on anodizing over zinc chromate prime there is a section on anodizing, both ch acid and sulfuric acid processes, on 35-41 of the 1944 edition of the PLATIN FINISHING GUIDEBOOK.

Nickel Salt Paste

Question: In the October edition of *Finishing*, just received, I notice in PROBLEMS a patented formula you gi nickel salt paste used for brushing wit rent. This interests me highly, and wondering if you have in your file mulas of the kind for gold and silv brushing with current.

S.

Answer: Formulas for a number of are given in the patent, and we would gest that you obtain a copy by forw 10c in coin together with the number patent to the Commissioner of Patents, ington, D. C.

Pink Gold Solution

Question: Will you please furnish m a formula for a pink gold solution, su is used on novelty jewelry?

S.

Answer: The following is suggeste

46% sodium gold cyanide	½ o
Sodium cyanide	½
Copper cyanide	⅛
Nickel cyanide	⅛
Disodium phosphate	1

Temperature 160°F.

Solid Gold Stripping

Question: Please furnish me a formu solid gold stripping.

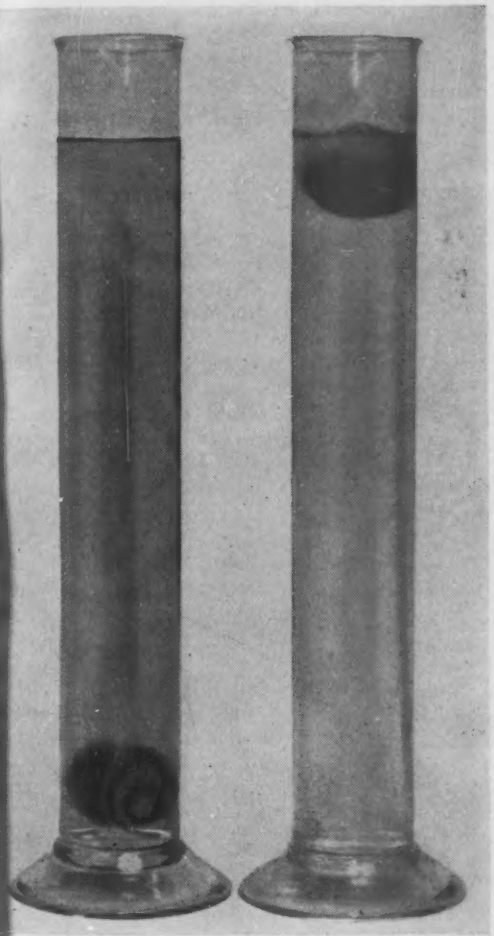
C.

Answer: The gold articles shoul pickled in hot 10% sulfuric acid so and then stripped anodically in the f ing solution at six volts and 190°F. slow agitation:

Sodium cyanide	
Rochelle salt	
Potassium ferrocyanide	
Water	

REMOVE SCALE AFTER HEAT TREAT

WITH DIVERSEY EVERITE



Diversey Everite is a powerful solvent specially developed to remove heat scale quickly and completely without harming the sound metal. Will not change dimensions of forgings and castings. Also removes rust from metal surfaces. Reduces hydrogen embrittlement. Economical . . . works only on oxide and other unwanted deposits . . . not on the metal. Easy to use by soak or circulating method. P.S.—Remove quenching oil with Diversey DC-22 in tank cleaning or DC-14 in power washer.

1. REDUCES HYDROGEN EMBRITTLEMENT

Here's proof—Place a small wad of steel wool in graduates filled with Diversey Everite and raw acid. Note how the steel wool is carried to the surface by bubbles of hydrogen released by the raw acid. In the Everite solution, the steel wool remains at the bottom . . . there's no evolution of hydrogen, no corrosion.

2. WILL NOT INJURE METAL SURFACE

Here's proof—Select two rusty pieces of steel. Place one in a solution of Diversey Everite and the other in raw acid. Note how Everite removes the rust quickly and completely, AND THEN STOPS while the raw acid continues to dissolve the sound metal after the rust is gone.

For Liberal Experimental Sample Write Metal Industries Dept.

THE DIVERSEY CORPORATION 53 W. Jackson Blvd. Chicago 4, Ill.

. . . HELP WANTED? JUST CALL A

DIVERSEY D-MAN

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

New Artificial Wax

A new artificial wax has been developed in the laboratory of The Roberts Rouge Co., Dept. MF, Stratford, Conn. This wax is known to the trade as "Robertswax" and has many characteristics of genuine bees wax. It is slightly tacky, of a light brown color with a slight pleasant odor.

Experimental work leading to the creation of this new wax was suggested owing to the scarcity of a suitable available material due to government requirements. It was originally hoped that some type of wax could be synthesized primarily for use as a binder for buffing compounds. As many times happens, the final resulting product was found to possess many other virtues which lend themselves readily to other important industrial uses.

In addition to use as a binder in buffing compounds, the cutlery trade is finding this wax a good substitute for other waxes formerly used by them. The comparative low cost of this wax is another factor which will appeal to many users of waxes of the more expensive types.

A large portion of the new addition to the factory will be devoted exclusively to the production of this wax which is offered to the trade in slabs 2 x 4½ x 18 inches, weighing five pounds each. The wax is priced at 13c per pound FOB Stratford.

Unlimited quantities are available and for the present at least no priority is required for the purchase or use of this wax. Small samples will be sent to interested concerns upon request.

As this wax is an entirely new product, correspondence with those interested in the technical features is solicited.

Masking Tape

A new tape used for the insulation of plating racks and for masking parts prior to selective plating has been announced by Michigan Chrome and Chemical Company, Dept. MF, 6340 East Jefferson Ave., Detroit, Mich.

This tape, to be known as Miccrotape, is the first product of its kind to be produced by an extruding process. This results in a slightly curved surface which feathers out to uniformly light edges. This feature makes the tape extremely easy to apply and permits unusually smooth overlapping and a snug fit around every surface.

When Miccrotape is used for the protection of plating racks, there are no pockets of any kind and no possibility of solutions being trapped during plating or cleaning cycles. It can be built up to any desired thickness and, by heating for an hour at approximately 300°F. will fuse into integral coating.

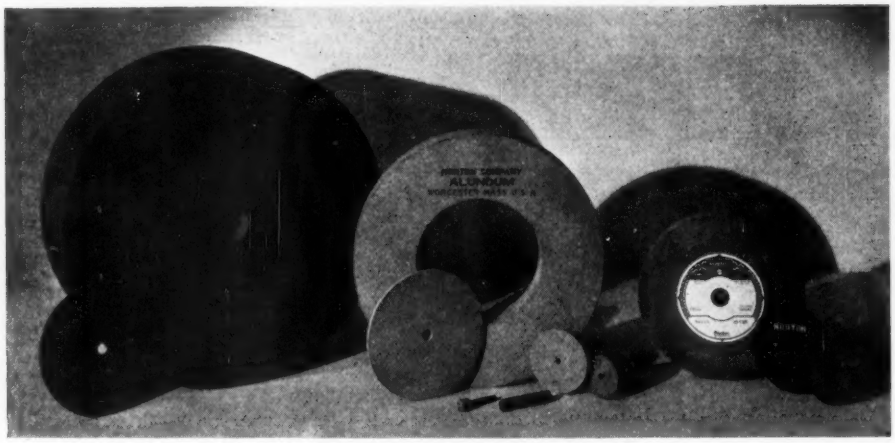
This tape has practically all of the physical characteristics of rubber and far passes its chemical resistance. It effective resistance to all plating solu including DuPont high speed copper, br tin, zinc, chromium and cadmium, and stands under actual operating condi boiling hot cleaning solutions and pic baths. It has high dielectric strength smooth, glossy surface allows more thor rinsing and drainage to minimize dra of solutions. It will not harden or after continued use and flexing in hot ers and plating solutions, but remains and permanently elastic to permit handling on steady production jobs. sufficient tensile strength to permit wrapping without breaking or tearing.

Miccrotape has no surface tackine stickiness but has exceptional propert cohesion. If wrapping is not complete rack can be put aside without danger tape unraveling. As racks can be use mediately after the tape is applied, especially valuable for use on rush plated jobs where the time element portant.

Repairs can be made at the time w new load is racked up with no loss of

When Miccrotape is used for masking for hard chrome plating or selective plating prior to carburizing, it is qu applied and no time-consuming hot seali necessary before it is used. The end cured by a dab of sealing cement furn for this purpose. It fits snugly in gr and around shoulders, making it partic useful in hard chrome work. After pl the tape can be quickly removed, leavi perfectly clean, unmarred surface. It been found that, after removal, this tap be used several more times before discarded.

Professional Directory



Solid Polishing Wheels

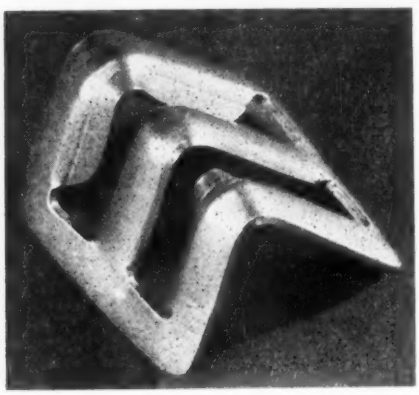
Norton Company, Dept. MF, of Worcester, Mass., announces a line of solid polishing wheels which are to be marketed under the trademark Norflex. They are available in three types: cork resinoid, fiber resinoid and resilient rubber, and together they make it possible to meet the special requirements of a wide range of de-burring, finishing and polishing operations—jobs which not so long ago were performed by slow and laborious hand filing, scraping and sanding.

All three types of Norflex abrasive wheels and sticks are similar in that they possess a relatively soft and flexible bond that imparts a cushion-like action, assuring a smooth uniform finish. They differ from the conventional grinding wheels in that they are designed to remove only a relatively small amount of material such as a burr or sharp edge or to polish a surface that is already to size rapidly and economically. The three types of wheels differ from each other with respect to the kind of flexible bond that supports the abrasive grain. Each has its own field of usefulness.

Alumon

The Enthone Co., Dept. MF, 514 Elm St., New Haven, Conn., have announced the development of a new, simple process for preparing aluminum for electroplating. The process is called the "Alumon" process.

It enables electroplating of all types of aluminum. Both rack and bulk work can be readily processed. The procedure consists in cleaning in the usual manner, followed by a short dip in the "Alumon" solution, which produces an active alloy base which can be subsequently copper or silver plated. After the work has been given a short copper plate, it can then be electroplated with other metals including nickel, chromium, gold, etc.



Aluminum buckle nickel plated using "Alumon" process bent to show adhesion at sharp bend.

At present it is being widely used for plating of aluminum radar equipment and other apparatus. Work plated by the "Alumon" process can be subjected to severe distortion without flaking and the plate can be readily soldered thus permitting easy soldering to work made of aluminum. A wide interest has developed in the process for post-war plating of such articles as costume jewelry, amulets, pencil points, and household goods.

The process is patented and the user is granted a license with no royalty payments other than the cost of the salts.

Literature is available describing the process.

Master Magnifier

A new assembly of wide field magnifiers with built-in illuminating units, operated by battery and by electric control, contains 7-power, 20-power and 40-power magnifiers. The 40-power is equipped with a 0.001″ scale. Can be used independently of outside illumination.

Provides laboratories and inspection departments with a highly efficient means of observing details invisible to the unaided eye. With these three magnifications and choice of battery or current for illumination, many problems are readily solved.

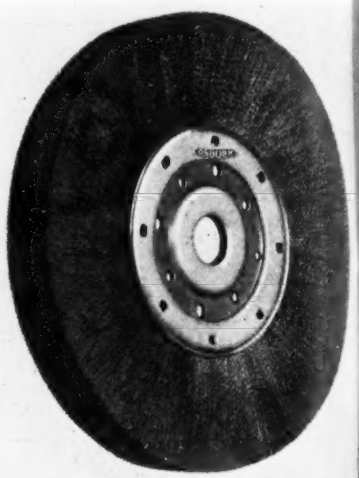
Useful for inspecting plating for pits, pinholes, texture; for inspecting metal for incipient cracks; also for inspecting welds for cracks; for detecting incipient corrosion; for precision measurements on tools and dies, measuring small holes and for critically inspecting finely edged and sharp pointed tools.

Write to R. P. Cargille, 118 Liberty St., New York 6, N. Y., for leaflet showing photomicrographs of effects obtained. Just mention Set 44 MF.

Power Brush

A new power brush for removing burrs, preparing metal surfaces, work on rubber parts and many other applications is announced by The Osborn Manufacturing Co., Cleveland, Ohio.

In the applications for which it has been especially designed, the brush has a cutting rate of four times as great and a brush life three times longer than the best fine-wire brushes manufactured up to this time, according to laboratory and field tests conducted by the manufacturer. The new brush, it is said, provides industry with a production tool capable of increasing production rates at a minimum end-of-service cost and extends the application of fine-wire brushes to work hitherto considered impractical.



Designated as the Osborn Monitor Brush No. 1409-S-22, it is a 12-inch monitor section filled with .005-inch Osborn power brush wire and has a 1¼-inch arbor hole. It is especially well suited to aluminum, brass and other ductile metals for removing burrs effectively without damaging adjacent surfaces of the part, according to the company and also will find extensive application on hardened and unhardened steel parts. This is because high level, uniform cutting ability is maintained throughout the life of the brush, a quality said to also make the brush suitable for rubber parts and similar applications where there is considerable resistance to the fill-wire.

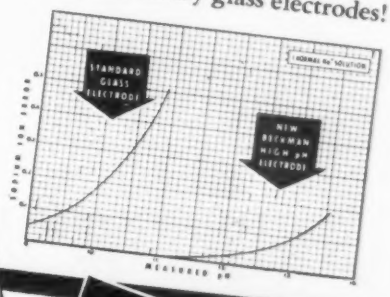
Complete details and analyses of successful applications for the new brush may be obtained by writing to the manufacturer, The Osborn Manufacturing Company, Dept. MF, 5401 Hamilton Avenue, Cleveland, Ohio, requesting information on Osborn Brush No. 1409-S-22.

Check your knowledge of pH

Do you know the answers to these important pH questions?

Q. *There is only ONE make of modern pH equipment with which accurate pH measurements can be made in highly alkaline solutions, even in the presence of sodium ions. Do you know what that make is?*

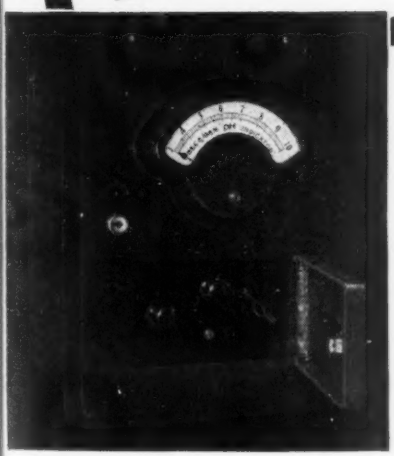
A. Beckman pH equipment—and *only* Beckman equipment! Note in chart the accuracy of Beckman Type E Glass Electrode in highly alkaline solutions compared with ordinary glass electrodes!



Q. *There is only ONE make of pH equipment with which glass electrode pH measurements can be made in boiling hot process solutions. Do you know the name of this equipment?*

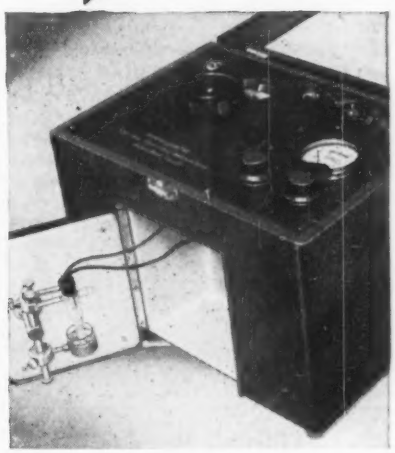
A. Again Beckman—and *only* Beckman! With Beckman High Temperature Glass Electrodes, continuous pH measurements can be made in solutions as hot as 100°C (212°F). This feature is highly important to consider in the purchase of pH equipment for *any* purpose. Even though your present operations may not involve hot solutions, you never know when changes or additions to your operations may obsolete equipment not providing this feature. Buy Beckman to begin with *and be sure!*

There's a Beckman pH instrument for your requirement.



Beckman Automatic pH Indicator
The most advanced pH instrument available for large-scale pH control. Indicates pH completely automatically. Also operates pH recording and control equipment!

Beckman Industrial pH Meter
Combines high accuracy with knockabout ruggedness for portable plant and field use. Gives instant pH readings at the touch of a button. Also *continuous* indication!



Beckman Laboratory pH Meter
Combines high precision with wide versatility to meet every laboratory and research need.

Free! "What Every Executive Should Know About pH"—a helpful factual guide to modern pH control. Send for your copy.

BECKMAN INSTRUMENTS NATIONAL TECHNICAL LABORATORIES
South Pasadena • California

BECKMAN INSTRUMENTS CONTROL MODERN INDUSTRIES

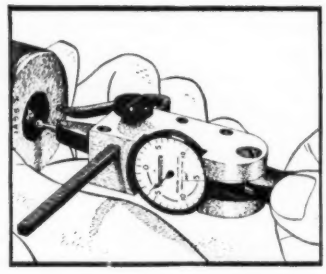
New Internal Gage Avoids Over Cutting... Saves Wasted Man Hours

At last a gage that takes the guess work out of checking internal diameters either machine bored, or close ground and lapped. It is called the Keene Internal Gage and is the first accurate method for fast correct checking of internal splines and gears on both minimum and root diameters. The gage is ideal for machining and inspection work, and proves its value in increased production. It can be used with either a master, or micrometers.

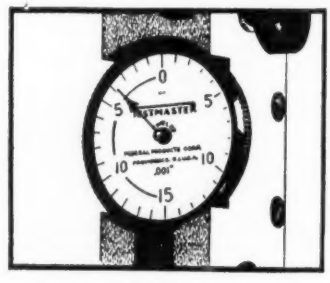
This time saving development is constructed of aluminum, is six inches long and weighs only five ounces. Available in models designed to read in thousandths (.001) or in tenths (.0001).

When your gage has been checked the thousandths left to bore, the actual job of machining may become tedious. It is then when Wrigley's Spearmint Gum helps keep you alert and watchful. Chewing gum seems to assist you over the dull spots in the day's work. And Wrigley's Spearmint will aid you in your peacetime job by helping to keep you wide awake and efficient during that part of your work that may seem unimportant, but which actually means perfection to the completed product.

You can get complete information from Keene Electrical Machinery Co., 542 W. Washington Blvd., Chicago 6, Illinois.



Determining correct setting for gage.



Closeup of dial showing simplicity and fast visibility.

Z-51

Circuit Breaker

A new 100-ampere "De-ion" circuit breaker which requires less space and permits lighter structures for distribution panelboards, built-in applications and bus duct plug-ins is announced by Westinghouse Electric and Manufacturing Company.

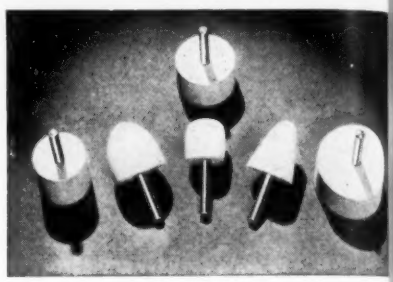
All ratings are available in one compact breaker with uniform pole spacings and terminal arrangement, providing complete interchangeability between ratings. The new F Frame permits for the first time a 100-ampere, 600-volt a-c or 250-volt d-c breaker in the same space formerly required by the 50-ampere, 600-volt a-c or 250-volt d-c rating.

Equipped with thermal and instantaneous magnetic trip elements, the "De-ion" fuseless circuit breaker permits maximum loading of circuits and fast resumption of interrupted service. Contact pressure increases with wear, thereby prolonging the life of contacts and breaker. Silver alloy contacts give increased contact life with lower wattage loss. The special alloys used also prevents "freezing." Both two and three-pole units are available.

Further information concerning the F Frame 100-ampere breaker may be secured from P. O. Box 868, Westinghouse Electric and Manufacturing Company, Dept. Y, Pittsburgh 30, Pa.

Mandrel-Mounted Bobs

Users of felt bobs for polishing, finishing and deburring metals, plastics, etc., can now



secure the well-known Paramount Brand Felt Bobs permanently mounted on ⅛" or ¼" steel mandrels. Bacon Felt Co., Dept. MF, Winchester, Mass., the manufacturer, announce these mandrel-mounted bobs as a new convenience for use with portable air or electric tools, flexible shaft equipment, drill presses, lathes, etc. When the felt has worn out, the operator simply slips one of these new mandrel-mounted bobs in place—no time wasted removing the felt stub from the mandrel and fitting a new felt on the old mandrel. Aside from the saving of time, there is the advantage of knowing that the bob has been trued up and securely and permanently attached to the mandrel at the factory. Further details will gladly be furnished by the manufacturer.

Acid-Proof Apron

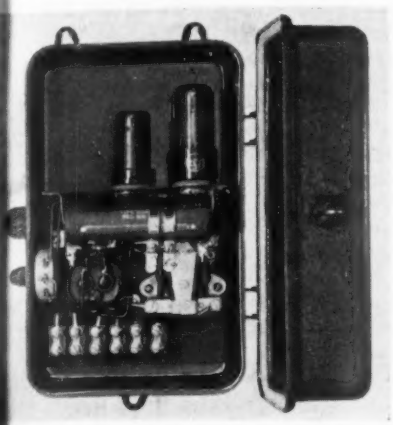
A new heavy duty acid-proof apron, made with a treated fabric combined with a neoprene plastic by a special calendering process which impregnates the fabric so the product is acid-proof throughout is announced by The B. F. Goodrich Company, Dept. MF, Akron, Ohio.

The apron is made in one size only, 36 inches by 47 inches, full. It weighs 1½ pounds complete with sturdy ⅞ inch web tape, criss-cross shoulder design, attached securely with reinforced grommets at top and side, and with edges hemmed throughout. It can be easily washed or cleaned without harm to its acid-proof qualities.

Electronic Concentrate Control

Photoswitch Incorporated, Dept. MF, Cambridge, Mass., announces an Electronic Concentrate Control for detecting and controlling through operation of signals, valves or pumps changes in liquid concentrations. This electronic method provides precise and accurate control for all applications in which changes in concentration are accompanied by a

esponding change in electrical conductivity. Installation is made quickly and easily and requires only that a probe fitting be mounted



on the tank, with probe extending into the liquid. This probe is wired to the electronic control which may be located wherever desired. An adjustment on the control housing is set so that the control relay will operate when liquid of a predetermined electrical resistance contacts the probe. While the probe is immersed in liquid of any other resistance, the control remains inoperative, but when a change in concentration alters the conductivity of the liquid to the necessary degree, the electronic control relay is energized to operate signals, valves or pumps.

Type P25N is used wherever it is necessary to maintain an interface between two liquids differing even slightly in electrical conductivity. Electronic operation thus permits single or two-level control of one liquid within a tank, even though another liquid may be above or below it.

Type P25N has a sensitivity range of 100 to 5,000 ohms and operates on a 5% change in probe-circuit resistance. The predetermined resistance valve for which the control is set remains fixed regardless of variations in line voltage or tube characteristics. The voltage applied to the probe never exceeds 25 volts, thereby eliminating any possibility of electrical shock or explosion hazard. Type P25N incorporates a single-pole, double-throw relay, rated at 10 amperes a.c., 5 amperes d.c., for normally closed and normally open operation, and requires a supply of 115 volts a.c. 60 cycles.

Face Shield

An improved type of face protection shield, designed for maximum comfort, has just been developed by Willson Products, Inc., Dept. MF, Reading, Pa., for light duty operations such as spot welding, light grinding, and woodworking.

Made to fit over correction spectacles and

extending well back along the sides of the face, the shield provides complete protection for face and forehead.

Extremely light in weight, the new Protecto-Shield (Type V-1) offers these additional comfort features: (1) adjustable headband which assures perfect fit, (2) front cushioning with replaceable leather sweatband, (3) back cushioning with pliable plastic tube, (4) tough lightweight brow guard which protects the forehead, and (5) combination friction swivel and guard which permits easy raising of the shield but prevents blows from pressing it against the face.

Slot locks hold the easily replaceable cellulose acetate visor securely in place and an aluminum edge prevents warping.

Fog-Free Goggle

Normal breathing has been harnessed for the first time to make a natural ventilating pump for a new goggle which cannot cloud up or fog, regardless of how much the wearer perspires. Fitted with a bulbous nosepiece, the new fog-free goggle is powered by ordinary lung action. Just normal breathing sweeps a complete change of fresh air in front of the wearer's eyes about once every second. This action removes moisture from within the goggle before there is enough of it to condense as fog on the plastic goggle lens, thus providing unblocked vision as well as eye-protection against dust and other flying particles.

The new goggle, designed by Polaroid Corporation engineers, employs the ba two elements required in all successful v tilation systems, flow channels to guide circulation efficiently, and a pump to keep flowing constantly, under all conditions. T flow channels are built into the goggle fram the pump is the wearer's lungs.

Inhalation draws air through the inta ports of the goggle. The air then swee across the inside of the lens, and pas through an inlet valve into the nose. E halation closes the inlet valve and opens outlet valve in the base of the protrudi nosepiece.

Further information may be obtained writing to the Polaroid Corporation, De MF, Cambridge 39, Mass.

Silver Deposit on Plastics

Langlotz & Co. Dept. MF, 1 Hanson Pla Brooklyn, N. Y. have developed a process chemically depositing silver on various typ of plastics, wood, cardboard, etc. and th coating with suitable lacquers which pr duces a lustrous finish.

The process is inexpensive, requires great amount of equipment, and the pr duction cost is very low. It requires cleaning or buffing and gives a lustre whi is quite superior to plating. In platin objects with undercuts there is always t problem of buffing properly whereas with th method, the deepest undercuts can be mad quite as bright and lustrous as the oth parts of the object.

Silvering by the conventional methods do not produce these results but they hav found that using the Mirr-O-Mist metho of spray silvering gives an adhesion an lustre which seems to be quite impossib by other methods.

Leg Apron

To take the place of overalls, but at t same time furnish the clothes protection

overalls, a split-leg apron is announced Canvas Products Corporation, Dept. M Fond du Lac, Wisc., under the trade nam "Canpro." Easier to slip on and off tha overalls, it furnishes the "around-the-leg pro tection" that is important in handling keg boxes, etc. It is especially designed fo workmen who do heavy work and who nee a tough, durable apron to protect clothing Made from heavy O. D. water-repellent can vas that is extra heavy at all points o reinforcement, the "Canpro" split-leg apro is doubly reinforced at the midsection an at the knees, and has plenty of pocket spa

pockets that cannot pull loose. It extends far below the knees but is comfortable to wear. Reasonably priced, it is high quality and long-wearing.

Rapid Water Analysis Apparatus

The Aero-Titrater, a product of Chief Chemical Corporation, Dept. MF, 1123 Broadway, New York City 10, furnishes the plant operator and laboratory technician with a rapid, precise method for the determination of hardness, calcium and magnesium in waters, both industrial and potable. It is also widely applicable to water problems in the process industries.

False endpoints are absent, and air agitation eliminates tedious and arm breaking shaking by hand. The accuracy is comparable with lengthy and laborious gravimetric methods, and substances ordinarily present in water do not interfere at all.

So simple is the apparatus that any operator can readily master its operation. It makes use of a new endpoint, based on the foam-meter principle. This endpoint is unmistakable and is reproducible with a high degree of precision. Determinations are made within ten minutes and there is no waiting time to observe stability of lather. The operation is foolproof and gives identical results with different operators.

The instrument is supplied calibrated and ready for assembly and use. There are no moving parts to wear out and no delicate features to go out of adjustment. All vital parts are of durable plastic construction.

The Aero-Titrater is devoid of the inherent and personal errors of conventional hardness analysis procedures. It effectively supplants the standard soap method for all uses, but it does much more—not only is it definitely more precise and rapid, it is also usable with waters which resist analysis by the traditional soap method. The ratio of calcium and magnesium present does not affect the determination; there is a single endpoint for stoichiometrically equivalent quantities of calcium and magnesium, regardless of the relative amounts present in the water.

Samples of 50 ml. or less are required. This is in contrast with gravimetric methods involving evaporation of one-half liter or more and subsequent precipitation waiting periods. The apparatus is equally at home in the field and in the plant. Chemists will find it a precision instrument thoroughly reliable in research work of the highest order.

So well does it function in the presence of interfering substances that it can be used directly with samples which contain chlorides up to 2000 ppm. Sulfates up to 1000 are also without effect. Large iron concentrations, and the treating and conditioning chemicals and compounds used in boiler waters do not interfere.

The versatility of the Aero-Titrater is further demonstrated by the ease with which micro determination of calcium and magnesium in boiler scales, minerals, plant ash, rocks, sediments, and similar materials is made. In many cases these determinations are carried out in the presence of practically all the impurities in the samples. They are simple, accurate and reproducible.

Business Items

Mr. E. Cohan of *Cohan-Epner Co.*, 142 West 14th St., New York, N. Y., specialists in gold, silver and other precious metal plating, left on Wednesday, Jan. 3, 1945, for his annual vacation which he is spending in Clearwater, Fla. Mr. Cohan will return about March 1.

Andrew Kaul III has been elected president of the *Speer Carbon Company*, the *International Graphite and Electrode Corporation*, and the *Speer Resistor Corporation* with offices at St. Marys, Pa. Mr. Kaul assumed his new duties on December first.

The *Apollo Chemical Co., Inc.*, announces the opening of offices at 51 East 42nd St., New York, 17, N. Y. The Company is engaged in the buying and selling of chemicals, oils, waxes, resins, gums and all other chemical raw materials, and is offering a complete purchasing service including assistance in filing applications for allocated materials, priorities, etc.

The *Columbia Chemical Division* of the *Pittsburgh Plate Glass Company*, in anticipation of greatly increased industrial activity on the Pacific Coast, has acquired the plant and sales organization of the *Pacific Alkali Company*, *E. T. Asplundh*, vice-president, announced here.

The Alkali Company has a plant at Bartlett, Calif., 220 miles north of Los Angeles, where it has been making soda ash, borax, and sesqui carbonate of soda, which includes

a group of household and industrial ... ing agents.

W. I. Galliher, executive sales manag... Columbia Chemical, disclosed, after a ... of inspection to the Pacific Coast, th... district sales office will be opened in ... Francisco. This will be in addition to ... Alkali Company's Los Angeles office.

The present personnel of Pacific Al... including *George D. Dub*, supervisor of ... plant, has been retained.

The *Optimus Detergents Company* has ... organized and is in operation at Mata... N. J., manufacturing industrial deterg... and developing new cleaning methods ... industrial use in its research laboratory ... pilot plant.

The Optimus Detergents Company ... also have available the facilities of its ... ciates, *Optimus Equipment Company*, so ... cleaning methods to be followed can, w... needed, be utilized and developed with ... aid of specialized cleaning equipment.

The Optimus Detergents Company ... Optimus Equipment Company functio... close affiliation with the *Hanson-Van Wi... Munning Co.*, also of Matawan, N. J.

Sole distribution agency of the new ... Free, Dust-Free goggle is *Welsh Manu... turing Company* of Providence, R. I., ma... and distributors of various types of ... protection devices. Welsh is launching ... new goggle with a nation-wide promot... and trade advertising campaign, offering ... goggle for immediate distribution to jo...

First plant in Chicago's newest indu... district at Addison St. and Kedzie Ave. ... be constructed for *Crown Rheostat & S... Co.*, manufacturers of plating equipme...

This was announced by *G. E. Huener*, ... president of the company, and *H. ... Phelps*, vice-president of *Clearing Indu... District, Inc.*

The transaction involves the sale of ... square feet of ground at 3449 N. Ki... Ave. on which a one-story plant cont... approximately 30,000 square feet of ... space is being built.

"YES, DEAR, I KNOW THE GOVERNMENT ADVISES US TO USE OUR ... PURCHASING POWER TO PAY DEBTS, BUT THEY MEANT OLD DEBTS"

Mr. Joseph B. Kushner, well-known electroplating engineer announces that he is now back, full time, at his regular consulting

Joseph B. Kushner

offices, 233 W. 26th St., N. Y. C., after an absence of more than a year and a half devoted to special work at Columbia University. He is now able to give, once more, his full time to development, research and consulting work in the fields of electrodeposition and plating plant design and installation. His specialties are streamlining and standardization of plating plant processes and design and development of automatic equipment for handling different production plating problems in war plants.

John C. Straub, for the last thirteen years associated with the Research Laboratories Division of *General Motors Corp.*, Detroit, has been appointed Research Engineer of *American Foundry Equipment Co.*, Mishawaka, Ind.

Mr. Straub has been actively engaged in the study of the durability and fatigue life of automotive and aircraft transmission and spur gears and is co-author with *J. O. Almen* of the General Motors Research Laboratories of several technical papers dealing with this and other subjects.

Announcement has been made by General Ceramics Company, Keasbey, N. J., that their line of chemical stoneware processing equipment is now being represented in the central states by *F. M. de Beers & Associates*, Chemical Engineers, with headquarters at 20 North Wacker Drive, Chicago, Ill.

Mr. F. M. de Beers, who heads this engineering service group, is a chemical engineer, sales consultant, and contractors' and manufacturers' representative with many years of wide experience.

The territory covered by F. M. de Beers & Associates for General Ceramics Company includes the middle west from Cleveland and Cincinnati on the east down to Covington and northern part of Kentucky westward through entire state of Missouri and everything north to the Canadian line.

Lawrence F. Griffin, 132 Avon Ave., Stratford, Conn., has been appointed New England representative by *Mr. Howard McAleer*, president of *Formax Mfg. Corp.*

Lawrence F. Griffin

Mr. Griffin finished Technical High School, Waterbury, Conn., and attended Yale, specializing on Surface Finishing and Metallurgy. He has worked for the Bridgeport Brass Company and also had charge of Zinc Plating at General Electric, Bridgeport, Conn. He has had a varied sales engineering experience, selling polishing and buffing compounds in all the New England States and is now working in cooperation with the Formax New England distributors, *MacDermid, Inc.* of Waterbury, Conn., and *Sessions-Gifford Company* of Providence, R. I., who carry large stocks of Formax products.

The Coloron Corporation, Albany, N. Y., announces through *Clements Batcheller*, president, the formation of *The Coloron Co. (Canada), Ltd.*, with headquarters in Toronto, Canada.

The newly formed corporation will function as a subsidiary of Stanley Manufacturing Company, Ltd., also of Toronto. Stanley are the largest manufacturers of metal printing plates in the Dominion.

Operating licenses have been granted the new company, under the Batcheller-Coloron Canadian patents to manufacture all types of stainless steel name and printing plates.

Plans are being rushed to get the new company into commercial production at the earliest date possible, because of the high established importance of the "all-metal" Coloron stainless steel printing plates to the current war effort.

The first honorary degree of doctor of science ever to be conferred by St. Bonaventure College has been awarded to *Henri van der Horst*, Dutch inventor and founder of the *Van der Horst Corp. of America*.

The degree was presented recently to Van der Horst, who has invented a process for applying chromium to the cylinders of internal combustion engines.

L. V. Nagle, National Sales Manager for the *Udylite Corporation*, Detroit, announces the following changes in personnel in the company's current expansion program.

Jack Hoffman

Bert Lupien

Joe Hoefer

Jack Hoffman formerly manager of the Cleveland territory is being transferred to the Detroit office to head the newly organized commercial filter division.

Bert Lupien formerly Michigan representative for the Corporation has been made manager of the Cleveland territory.

Joe Hoefer formerly with Udylite, returns to the Corporation to become Sales and Service Engineer for the Michigan territory in the position left by Bert Lupien.

Leonard Singer, Engineer for the Udylite Home Office for several years is being transferred to the Udylite New York Office where he will act as Service Engineer for that territory.

TECHNICAL DEVELOPMENTS

(*Continued from page* 20)

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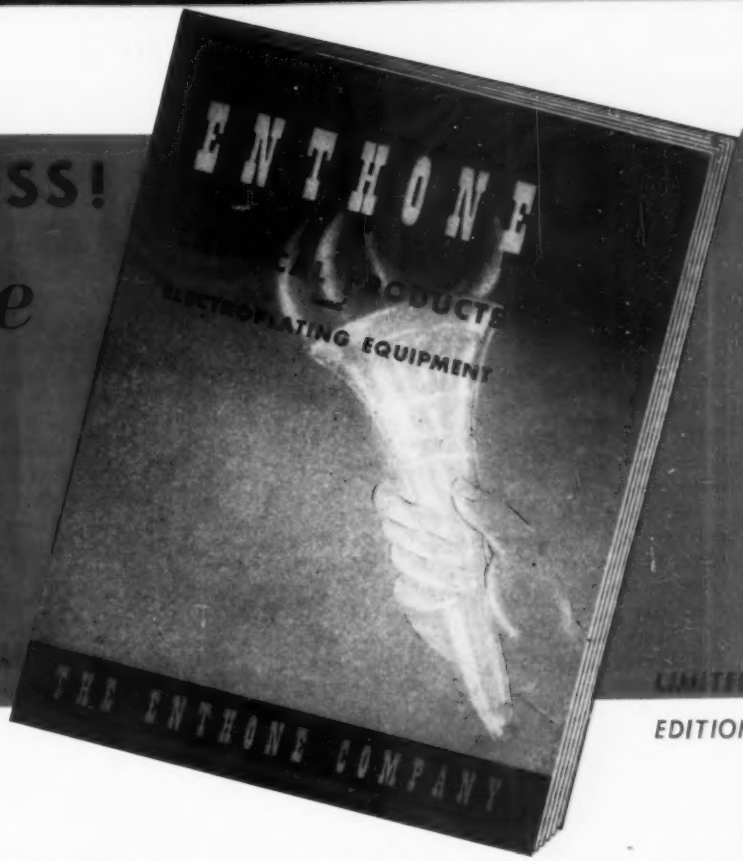
UST OFF THE PRESS!

New Brochure

31 ENTHONE INISHING PROCESSES AND O EQUIPMENT ITEMS



LIMITED EDITION

Contents

ACID ADDITION AGENT: A liquid, surface active material for acid pickles to stop fuming, lower surface tension, displace oil films, promote smoother and better pickling of steel.

ALKALI CLEANERS: A full line of high detergency cleaners for cleaning aluminum, zinc, brass and steel.

ALUMON: A simple process for electroplating upon aluminum.

EBONOL "C": A simple process for blackening copper, brass and bronze. Coating is jet black, very adherent, adsorptive cupric oxide. Greatly superior to black nickel and sulphide blackening. High corrosion protection. (U. S. Patent 2,364,993).

EBONOL "S": A simple process for blackening steel in temperature range of 285-290°F. Coating is ferroferric oxide.

EBONOL "Z": A very simple process for blackening zinc and zinc alloys. An excellent method of treating zinc surfaces to insure adhesion of organic finishes.

EMULSION CLEANER: An emulsifiable solvent for pre-cleaning all metals to remove oil and solid dirt. Enables faster cleaning and complete dirt removal for lacquering, enameling or plating.

EMULSION CLEANER CONCENTRATE: A concentate to be mixed with solvents to make emulsion cleaners at low cost.

ENAMEL STRIPPERS: Emulsion type strippers for stripping enamels from all metals without attack. Very fast acting. Two types—Enamel Stripper Regular—an emulsion type, and Stripper "P" which forms a clear dispersion with water and which is particularly good for stripping urea - formaldehyde type enamels. Alkaline strippers also available. (U. S. Patent 2,242,106).

FLUX NO. 20: A flux for soldering to steel where corrosion must not occur.

LACQUER RETARDER: A high boiling blend of special nitrocellulose and resin solvents to stop "blushing" of lacquers when drying in warm humid weather. Very effective and widely compatible.

METAL COLORING: Special simple processes for chemically coloring copper and brasses. Yellow, gold, brown, blue and iridescent finishes. Highly decorative and stable.

RUST PROOFING OIL NO. 15: A thin film oil with high rust-proofing characteristics. Film thickness 0.0002 inch withstands 24 hour salt spray. A water shedding polar solvent type rust-proofing oil.

SOLUBLE OIL: An emulsifiable rust-proofing oil used diluted with water to apply a rust-proofing film. Can be used with hot or cold water. Also an excellent cutting oil.

1568 WAX: An emulsion of clear hard drying waxes to produce a hard rust-proofing finish on metals. Air dries fast and does not rub off.

1569 WAX: The same wax as 1568 but dyed black for application to black surfaces.

ZINC STRIPPER: An alkaline process for very rapid stripping of zinc plating from steel without any attack on the steel. Process uses no current and is a simple immersion procedure. Zinc 0.0001" thick stripped in a few seconds. Patent pending.

—AND A FULL LINE OF PLATING EQUIPMENT AND SUPPLIES.

ENTHONE

CHEMICAL PRODUCTS • ELECTROPLATING EQUIPMENT

444 ELM STREET • NEW HAVEN 2, CONN.

THE ENTHONE COMPANY
444 Elm Street, New Haven 2, Conn.

Gentlemen: Please send a copy of your new Brochure on Enthone Finishing Processes and Equipment.

Name .....

Title .....

Firm .....

Associations and Societies

American Electroplaters' Society

Toronto Branch

The December meeting of *Toronto Branch, A.E.S.*, held in the Club Room of Royal York Hotel, opened at 8:15 P. M. with *Allan Byers* in the chair.

Mr. E. B. Creighton, the Branch secretary-treasurer, is now obliged to be out of the city many meeting dates and asked to be relieved of the duties of his office. To make the work easy for newly elected candidates for the office, it was suggested that the duties of secretary-treasurer be divided into two offices. As a result of brief discussion, *Mr. Mel Green* was elected secretary, and *Mr. Ted Blandey* treasurer. *Ben Cameron* was elected trustee in place of Ted Blandey who previously held that office.

The feature of the evening was a very interesting and instructive talk by *Mr. L. J. Durney* of *Sulphur Products*, Greensburg, Pa., whose subject was "Stripping by use of Liquid Sulphur." Mr. Durney made particular mention of the efficiency of the process for stripping copper for selective carburizing, and said a surge of new carburizing methods brought about a greater demand for a liquid form of the stripping medium. A review of various methods was given and reasons why they were now out of date were advanced. One fault with the old methods is the excessive time required and the use of current. Slides showing graphs, etc., illustrating rate of penetration, etc., were explained in detail. Mr. Durney said the Liquid Sulphur method strips evenly, and that 0.0015" of copper had been removed from an inside surface in forty minutes. A 40% labor saving was reported on one job. Wetting agents in cleaning or plating solutions do no particular harm. Various actions and effects of sulphurizing for decorative purposes were explained. Samples of finishes on brass were shown.

A rising vote of thanks was given Mr. Durney and the Sulphur Products Company for this interesting talk. Mr. Durney presented his subject in a very masterly manner and readily answered all questions.

W. S. Barrows.

Newark Branch

The *Newark Branch* of the *American Electroplaters' Society* wishes to announce that the *Winter Open Educational Meeting* will be held at the Robert Treat Hotel, on January 19, 1945, at 8 P. M.

The educational value of these meetings have proven themselves worthy of the achievements and prestige which Newark Branch has enjoyed as one of the largest branches in the society over a period of many years.

These meetings are primarily arranged to further the education of anyone engaged in, or connected with, the finishing and protection of metals. Another object of these meetings is to promote better understanding and personal contact between the technical personnel and the men actively engaged in production plating.

The following speakers will be presented at the January meeting:

Floyd F. Oplinger of *E. I. duPont de Nemours Company*, Wilmington, Del.; *N. I. Promisel* of the *Navy Department, Bureau of Aeronautics*, Washington, D. C.; *Kenneth Compton* of *Bell Telephone Laboratories*, New York, N. Y.

Boston Branch

The Boston Branch of the American Electroplaters' Society will hold its Tenth Annual Technical Session and Banquet, Saturday, March 3, 1945.

Grand Rapids Branch

The Grand Rapids Branch of the American Electroplaters' Society will hold its Annual Educational Session and Dinner Dance on January 20, 1945 at the Pantlind Hotel. A very interesting program, which includes nationally known speakers, is scheduled for the educational session. An equally fine program, which includes outstanding entertainment, is planned for the dinner dance.

The educational program is scheduled for 2:00 P.M. and the banquet for 7:00 P.M.

Waterbury Branch

The December 8th meeting of Waterbury Branch was opened at the Hotel Elton

promptly at 8:30 P.M. by President Maz with comments on the new form of the "Proceedings of the Society." The book form in which these papers have been issued is certainly a very great improvement and those who have instigated and directed this change are surely to be complimented. All members are urged to return the cards sent out by the Review with their comments and criticisms as this questionnaire will greatly aid in the publication of a magazine of greatest benefit to the organization.

Joe Thompson, technical chairman of the evening, took over the program, presenting first *Jack Hyner* with the Monthly Book Review. Again this Review is actually concerned with one of the current papers, "Building Up Worn Parts by Electrodeposition," by Hothersall, published in "Iron Age" for November, 1944. This is a very excellent paper on the subject of heavy deposits, particularly in that it contains numerous valuable tables which are normally difficult to obtain. *Bill Starr* in his talk on priorities briefly summarized the opportunity and method in obtaining equipment for civilian production.

Mr. Raymond H. Wallace, New England manager of *Paasche Airbrush Co.*, in his talk "Automatic Production Spraying", emphasized the recent rapid advancement and refinements in automatic spray painting equipment. Equipment of this nature has speeded up production tremendously; however, in many cases where production is low it is of distinct advantage as it has many things to recommend it over manual spray painting. A truly appreciative audience gave him a rising vote of thanks at the end of the discussion.

S. L. Henn, Secretary

Los Angeles Branch

A talk on conveyorized bright nickel operations by *Harold Schoonover*, chief chemist, *L. H. Butcher & Co.*, Los Angeles, highlighted the educational program of the December 11 meeting of the *Los Angeles Branch* of the *American Electroplaters' Society*.

Mr. Schoonover's discussion dealt primarily with the period he spent in the employ of the General Motors Corp. in Detroit, which firm at that time operated a conveyorized bright nickel system of some 30 or more tanks. The conveyor, Mr. Schoonover explained, was equipped with 110 hangers and moved at the rate of 2-2/3 feet per minute, requiring 1 hr. 7 min. to make a complete circuit. The system was operated 20 hours daily, 6 days a week, running 10,000 square feet of work per day. All parts were automatically buffed.

Mr. Schoonover first described the five cleaner tanks which headed the conveyor system, and followed with details of the composition and temperature of the solution, length of immersion and other technical data. He then described the remainder of the tanks in the line, together with their solutions and data dealing with racking, spraying and inspection methods.

A 30-minute question and answer period was presided over by *Earl Coffin*, chairman

of the educational committee, at the close of Mr. Schoonover's address. The cleaning method and types of cleaning solutions used in the conveyor system elicited considerable debate.

In response to several questions pertaining to cleaning, Mr. Schoonover elaborated on that phase of his talk. He explained that many of the parts processed were of a recessed or ribbed construction which made an effective cleaning system imperative.

The first of the five cleaner tanks, he said, contained a solvent cleaner in which the parts were immersed 5 to 7 minutes, the speed of the conveyor being geared to meet the requirements of the type of work going through on a particular day. The second tank was a dragout tank and No. 3 was a soap cleaner tank, with 2 ounces of mild alkali run at a temperature of 205 degrees, in which immersion time was 30 seconds.

Tank No. 4 was also a cleansing tank containing a mild alkali in proportions of one ounce per gallon, with immersion time of 15 seconds. Tank No. 5 was an electric cleaner, with a solution of 4 ounces per gallon of ordinary alkali and was run at 205 degrees. Time of immersion for the parts was 30 seconds.

Marcus Rynkofs, general chairman of a committee appointed at the previous meeting to investigate the practicability of holding an annual educational session in 1945, reported that the committee had come to the conclusion the Branch should not break the continuity of such annual sessions which have been given for a number of years. It was thereupon voted to hold the 1945 educational session at the Los Angeles Breakfast Club on Saturday, March 24.

The following committee, headed by Mr. Rynkofs, has been delegated to arrange the annual educational session as well as to handle the preparation and distribution of the program: *Frank Bunker, E. W. Wells, Earl Coffin, D. N. Ekdred, Don Bedwell, Emmette Holman, Ernest Lamoreaux, Howard Woodward, Clarence E. Thornton, Dean W. Williams* and *Joseph Sunderhaus.*

Approved for membership in the Branch were *Edward George,* Ace Plating Co.; *Albert Endemano,* Endemano Plating Works; *Burt C. Tuthill,* Cadmium and Nickel Plating Co., and *Gerald Shirley,* affiliated with Spokane Air Technical Service, Galena, Wash.

The applications of the following were received and referred to the Board of Managers for decision: *Edward B. Straeker* and *Glenn A. Hall,* both with the U. S. Dry Dock on Terminal Island, Los Angeles Harbor.

Rochester Branch

The *Rochester Branch* of the *American Electroplaters' Society* held the regular monthly meeting Friday evening December 15, 1944.

Minutes and treasury report were dispensed with because of the absence of the Secretary-Treasurer and because of travel conditions for Mr. Mesle, the speaker for the evening.

Mr. Mesle spoke for the Research Program and Fund. He gave a talk on silver plating bearings with thickness ranging from 0.010" to 0.060" for the aircraft industry. Mr. Mesle has worked very seriously at this process and

has published his paper in the Review and given his talk to many Branches. The members voted that the Research fund be given $100 from the treasury of the Rochester Branch.

Because of the bad weather conditions in Rochester, very few of the members were able to attend this meeting. Mr. Mesle would have had a much better turnout if the city hadn't been tied up because of a heavy snowstorm. All who attended enjoyed the meeting.

The meeting was adjourned at 10:30.

Donald C. Blum, Secretary

Engineers Council

At the 1944 annual meeting of the *Engineers Council for Professional Development* held recently in New York, *Everett S. Lee*, engineer in charge of *General Electric's* general engineering laboratory at Schenectady, was re-elected chairman of the council for 1945.

The ECPD is a conference of engineering organizations, formed to enhance the professional status of engineers through cooperative effort. Its constituent organizations are the *American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Chemical Engineers, The Engineering Institute of Canada, Society for the Promotion of Engineering Education*, and the *National Council of State Boards of Engineering Examiners.*

Coming Educational Sessions and Banquets

of the

American Electroplaters' Society

Grand Rapids Branch

Seventh Annual Educational Session and Dinner Dance

JANUARY 20, 1945

at the

PANTLIND HOTEL

Educational Session 2 P.M. Banquet 7 P.M.

Chicago Branch

Thirty-third Annual Educational Session and Dinner Dance

JANUARY 27, 1945

at the

PALMER HOUSE

Baltimore-Washington Branch

Annual Educational Session and Dinner Dance

FEBRUARY 3, 1945

at the

MARYLAND YACHT CLUB

Broening Park, Baltimore, Md.

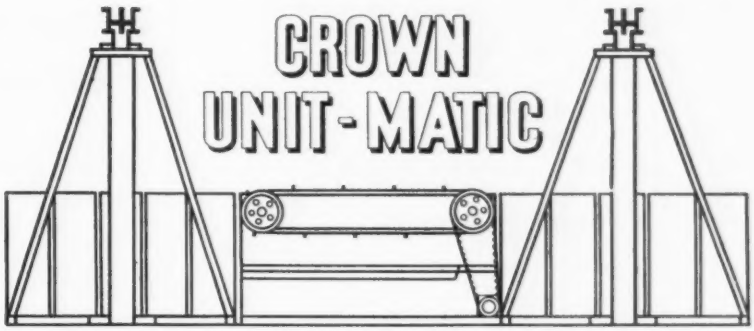
New Book

Industrial Instruments for Measurement and Control. By Thomas J. Rhodes. Published by *McGraw-Hill Book Co.*, 330 W. 42nd St., New York, N. Y. 573 pp. Price $6.00.

The preface states: "This book is intended for use as a textbook for the formal study of the subject of instruments and automatic control in engineering schools and as a practical reference book for those concerned with instrument and control problems in industry." For those who must read without benefit of a teacher the book leaves something to be desired. For example, the common pressure gage is stated to be "numerically the most important instrument used in industry." Nevertheless, the description of this simple gage is quite brief, and worse still, unnecessarily stuffy. An accompanying line sketch fails to clearly show the most important feature which is the partially flattened (Bourdon) tube. Terms are used in the text which apply to, but are not shown on, the sketch except for one unduly emphasized part.

One type of industrial thermometer is really a pressure gage. It is connected by tubing to a fluid filled metal bulb. Expansion and contraction of the fluid changes the pressure but the gage is calibrated to read, of course, temperature. This simple principle is handled by saying "The pressure-actuated recording or indicating thermometer may be defined as an instrument that uses the energy available in the form of increased pressure or volume of a substance to indicate and record the change in temperature that liberated the energy."

For the "old reliable" methods of instrumentation other texts have the advantage of clarity in explaining theory and application.



News from California
By FRED A. HERR

B[illegible] McQuoid of Burbank, Calif., is a tire an[illegible] he heads the McQuoid Tire Co.—but e[illegible] r emergency has made him, at least [illegible]arily, a part of the large fraternity of [illegible]s in Southern California required to [illegible] that the metal parts of airplanes are [illegible]y finished.

Mr. McQuoid's activities are indicative of [illegible] nner in which members of unrelated [illegible]ses are being drawn into metal finishing to supply the growing demand for such [illegible]rk.

Prior to the war his business was confined [illegible] sale of new tires and recapping and re[illegible]ading. Part of the equipment of his recap [illegible]op was a large kettle used for curing tires. [illegible] year ago the Lockheed and Vega aircraft [illegible]mpanies of Burbank found it difficult to [illegible] someone to reline with rubber the tumbling barrels used in their metal finishing [illegible]d processing divisions.

McQuoid heard of the matter. He made [illegible] few changes in his tire curing kettle and [illegible]perimented with applying thin coatings of [illegible]bber on metal surfaces. The idea worked. [illegible]ow McQuoid has the kettle working full[illegible]me, six days a week, rubber lining tumbling [illegible]rels. In addition he is turning out 70 [illegible]ed passenger-car tires a day with [illegible]r tire molds.

Lucian Gray of the *Norton Co.*, Detroit, is now serving as assistant on sales to *Philip H. Clapp*, Pacific Coast district manager, with headquarters in Los Angeles. Mr. Gray has been with the Norton Co. since 1916. In 1933 he was transferred to Flint, Mich., as an authority on abrasives in connection with aircraft engine production at General Motors, remaining in that position until his recent transfer to Los Angeles.

Western State Lacquer Co. is erecting an office building costing $7,000 at its Los Angeles plant, 4400 East Washington Blvd.

"BUT IT DOES SAVE ELECTRICITY, CLARENCE!"

Pasadena Research Laboratories, Inc., have been established at Pasadena, Calif., with capital stock of $100,000. *John E.* and *E. L. Gregory* and *Russell Bavouset* are announced as the directors.

William E. Simmons Co. has acquired the plant of the *Graham Mill & Lumber Co.* in Oakland, Calif., and is converting it into a metal manufacturing and processing plant.

Harry W. Haghn, formerly head of *Haghn Mfg. Co.*, has been named vice-president in charge of production and engineering of the *H. L. Harvil Mfg. Co.*, Los Angeles. More recently, Mr. Haghn had served as plant manager of the *Die Cast Corp.-Warner Mfg. Co.* of Glendale, Calif.

H. C. McClellan, president of the *Old Colony Paint & Chemical Co.*, appearing as representative of the *Los Angeles Paint, Varnish and Lacquer Association*, was the guest speaker on the Los Angeles *Times'* program, "Everybody's Hour," on December 10. Mr. McClellan discussed the importance of paint and lacquer for peacetime and war usage and revealed some of the unusual factors involved in their manufacture.

Courses in Electroplating

THE Institute of Electrochemistry and Metallurgy, 59-61 East Fourth St., New York City, will offer specialized courses in the field of electroplating and metallurgy during 1944-45. Registration will be held for the Spring courses from *January 29th to February 2nd* inclusive and the first class meeting will occur on *February 6th*. The following studies will be offered:

Electroplating II.

This course is designed to give the electroplater a knowledge of the ways and means of obtaining better deposits by applying the latest scientific methods of electrochemistry to electroplating. One hour of each evening will be devoted to a lecture on the theoretical aspects of the subject and two and one-half hours will be spent in the laboratory where the student will apply the principles set forth in the lecture. Copper, nickel, zinc, cadmium, chromium, silver, and brass will be deposited from aqueous solutions. While plating the above metals, the factors governing the character of the deposit such as current density, temperature, pH, etc. will be noted. Other experiments will include throwing power, single electrode potential, addition agents, resistance of solutions, anodizing and coloring aluminum, corrosion tests, etc. After these are complete the students will prepare standard solutions and make analyses of all the important constituents of the above plating baths. Tuesday and Wednesday, 7:30–11:00 P. M. Prerequisite: Electroplating I or its equivalent. *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Fee: $45.00.

Metallurgy II (Metallography).

This course is designed to teach the student preparation of metallographic samples for microscopic examination. Various samples of different metals and alloys will be polished, etched, and examined under the microscope. The detection of faulty alloys and metals will be stressed. *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Tuesday and Wednesday, 7:30–11:00 P. M. Fee: $25.00.

Research II

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One-half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00–11:00 P. M. *Dr. Young*. Fee: $30.00.

Time payments may be arranged if desired.

For further information call *Dr. C. B. F. Young*, ORchard 4-1778 or FLushing 9-1685.

Manufacturers' Literature

"Corrosion"

"Corrosion," a 54-page publication by *The International Nickel Company*, convenient and comprehensive analysis corrosion principles for both the practical man and the technician in the metal field has been prepared in the belief that a working knowledge of corrosion is the possible means of securing maximum equipment life and minimum maintenance cost situations where this destructive process must be taken into consideration.

An opening section explains how corrosion processes work, and discusses all known factors that influence their action acidity of solution, oxidizing agents, temperature, agitation, films, inhibitors, surface condition, stress, heat treatment, welding, concentration cells, and galvanic action. discussions are illustrated with graphs, drawings and tables.

The detailed review of testing methods follows tells how service conditions are simulated in corrosion research. Included description of the construction and use the well-known spool-type specimen holder for determining the comparative behavior several metals and alloys simultaneously under actual operating conditions.

The applicability of Monel, nickel, Inconel in various corrosive media is analyzed in the closing section of "Corrosion." Tables list nearly 500 typical corrosives which these alloys have been successfully used, and report the results of more than 120 specific tests under varied conditions 44 common corrosive agents.

"Corrosion" will be sent on request equipment designers, engineers, or

metal users, by The International Nickel Company, Inc., Dept. MF, 67 Wall St., New York 5, N. Y.

Temperature Control

So that everyone who is in any way concerned with the efficient operation of electrically-heated furnaces, ovens, baths or other units may know of a temperature control system now available for the first time, the Leeds & Northrup Company have just issued a new catalog. It describes a system designed especially to bring to electrically-heated units a regulation of heat-input as dependable as their Position-Adjustion Type of M.E.C. long has brought to fuel-fired furnaces.

This new 25-page publication explains how, by means of an "on-off" contacting system, the heating unit is fed the electric current needed to keep temperature to the required control point or program. Schematic illustrations show the reader how control action is obtained by regulating the proportion of time during which current is "full on" and "full off." Installation photos show the control system in use in representative plants. Also included is an explanation to show how easily an operator can "tune" the control to his particular process.

For a copy of *Micromax Electric Control —Duration-Adjusting Type*, write for Catalog N-OOA(2), *Leeds & Northrup Company*, Dept. MF, 4934 Stenton Avenue, Philadelphia 44, Pa.

Processing Carriers

Manufacturers whose products or metal parts go through various finishing processes will be interested in the new *Rolock "Processing Carriers"* Catalog produced by *Rolock, Incorporated*, Dept. MF, 1350 Kings Highway, Fairfield, Conn.

The 24 page edition pictures and describes more than one hundred custom-built metal baskets, trays, crates, barrels, boxes and fixtures that have been designed to solve specific problems for better handling of metal parts. The carriers are sectionalized both under *Heat Treating* with all its various processing operations, *Fixtures, Pickling Equipment, Plating and Finishing* and *Metal Tanks*, and under design types of Carriers.

There are many interesting examples of unique construction in the section covering bottom dumping baskets and a wide range of shapes and sizes with capacities from a few ounces to 6000 lbs.

Rolock Processing Carriers are made from materials which give maximum resistance to all exposures and abrasion, for both manual use and for handling on rollers or with overhead conveyors. Welding has superseded other types of construction in most instances and greater strength has been obtained by new methods of support against stresses.

Rolock engineers accent the advantages of custom-built carriers, specifically designed for the particular duty and materials to be handled, both for the individual operation and processing cycles of different operations. Handling of larger loads, easier and faster, by means of stronger yet lighter weight carriers and the incorporation of features which save time between heat and quench operations are especially stressed.

Copies may be obtained by writing to the Rolock Corporation at the above address.

Burring Report

A report on "Removing Burrs With Power Brushes," containing extensive information on latest advanced techniques, procedures and equipment for such work, has been prepared by the technical department of The Osborn Manufacturing Company, Dept. MF, 5401 Hamilton Avenue, Cleveland, Ohio.

The report is contained in a 15-page, 8½ x 11 inch booklet with 23 illustrations covering brushing methods, fixtures and typical brushing applications. A careful description of different types of industrial brushes and their best applications has been prepared for those interested in the most effective use of this production tool for fast off-hand or automatic operation in removing burrs, scales and other similar work.

A brief summary chart lists the most commonly used brushes as well as their general applications. The report should prove of considerable value to all metal working plants.

The report is offered gratis and anyone desiring a copy should ask for "Report on Removing Burrs with Power Brushes."

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Display Advertisements, One Column Wide, $6 per inch, Each Insertion

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1—6000 AMP., CHANDEYSSON generator.
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2—4000 AMP., CHANDEYSSON generators.
1—5000/2500 AMP., 8/16 VOLT, BOGUE generator.
1—2500/1250 AMP., 6/12 VOLT, CONNECTICUT Motor Generator Set.
1—500 AMP., ROTH motor generator.
1—1500/750 AMP., 6/12 VOLT, OPTIMUS motor generator set.
1—1500/750 AMP., 6/12 VOLT, EDDY motor generator set.
1—1000/500 AMP., 6/12 VOLT, EDDY motor generator set.
20—GARDNER No. 3, BALL BEARING Polishing Machines.
15—GARDNER No. 3, 5 H.P. and 3 H.P. motor driven polishing and grinding machines—ball bearing.
1—UDYMATIC, 14 station, 3 Head Automatic polishing machine.
4—BAIRD No. 2, oblique, motor driven burnishing barrels.

The most complete line of Scratch brushes, buffs, felt wheels, emery wheels, buffing compounds, plating supplies, polishing supplies. All sizes and shapes.
Plastic finishing equipment and supplies a specialty.
PeKay-Synthetic rubber wheels for fine emerying and deburring. Cheapest, because they last longer. Sizes from 1"x⅛" to 12"x3".

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Industrial Filters and corrosion testing Equipment
Sterling motors—Gear reduced-Speed trol
Kocour—Testing Units—Bristol Controls
Boice-Crane Equipment for Plastics
Buffalo Blowers and Drill Presses

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Plating Barrels, Rheostats, Polishing machines, Utility Blower Systems, Burring machines on benches with Dust Removal System.
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30,000 cu. ft.— 5 inches static pressure.
15,000 cu. ft.—13 inches static pressure.
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2 Glascote, 5000 gal. open-top, steam jacketed stain kettles.
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1 Tolhurst, 40" stainless suspended centrifuge, bot discharge, perforated basket.
4—5000 gallon cypress storage tanks.
2—open-top stainless tanks—400 and 200 gallon.
1—Duriron, lead pump, 3 H.P. motor.
1—24"—Combs gyratory riddle.
1—Oster Pipe threading machine—up to 6".
1—American Pipe Bending Machine — up to 4" — h operated.

Also the following surplus chemicals:
No. 500 Aluminum hydroxide USP powder.
No. 6000 Magnesium sulfate USP crystal.
No. 800 Chromic acid flakes, technical.
No. 4800 Ammonium Sulfate—C.P. except for chlori
10 ton approx. ammonia alum. especially purified.

Address reply to: Bulova Watch Co., Dept. 56, Curtiss Field, Valley Stream, L. I., N. Y.

SITUATIONS OPEN

FOREMAN FOR METAL FINISHING PLANT

SITUATION OPEN—A Dallas, Texas, manufacturer of non-ferrous metal products, whose advertising we handle, has asked us to locate a qualified man to be foreman of metal finishing division. To qualify for this position you must have 5 years or more experience with alumiliting, chrome plating and other metal finishes. Prefer mechanical, electrical or chemical engineer. The metal finishing division of this company is large and adequately equipped. The manufacturer is currently engaged in war materiel production but will resume peacetime activity on a greatly enlarged scale when possible. Write us fully about your experience and salary requirements. Ask any questions about living conditions in Dallas. Your application will be referred to our client. Attention UC, Herbert Rogers Co., Advertising, 602 Wholesale Merchants Building, Dallas 2, Texas.

ELECTROPLATING & FINISHING EXPER

SITUATION OPEN—Thorough knowledge a broad experience in electroplating and metal ishing processes. Wanted to work with well est lished sales and service organization manufact ing products extremely essential in all kinds production, processing and maintenance wo Location N. Y. C. Must be willing to travel. G full details. Address: Box Jan. 3, care Metal Finis ing, 11 West 42nd Street, New York 18, N. Y.

COATING SPECIALIST

SITUATION OPEN—Large middlewest tank manufacturer is see a man experienced in plastics, enameling, and other coatings knowledge of modern production methods. Advise age, experi and by whom now or formerly employed. A splendid opportu for the man who can qualify. Address: Box Jan. 4, care M Finishing, 11 West 42nd Street, New York 18, N. Y.

« « « « « INDEX TO ADVERTISERS » » » » »

ODDS and ENDS

New Year's Resolution:

We hereby resolve not to become exasperated with correspondents who: Ask us to teach them how to finish all metals *by mail.*

Wish to know if nickel and chromium can be deposited in the usual order from *one* solution because they lack space. And, if not, will be satisfied with the reasons why but must have references, since they will not take the editor's word for it.

Send telegrams *collect*, asking for information.

Sign their names illegibly and request that the reply be addressed to their attention.

Write us three page letters *in pencil* — and forget to include the return address.

Don't renew their subscriptions and want to know why they haven't received the last four issues.

Want us to advise them, *in writing*, whether motor-generators are better than rectifiers, or vice-versa. (The Advertising Dep't. would probably go into convulsions).

Complain that the articles are too short, are too long, are too technical, are not technical enough, have too many formulas, don't have enough formulas.

We hereby resolve not to get nasty with such correspondents—but are afraid we do not have the strength of character required to refrain from breaking this resolution.

Poetry Dep't:

We have come upon a poem, described as a "poem of the futuristic water system", which we publish here for the edification of those among our readers who appreciate good poetry:

VISION

At first the Universe was a large bed of water,
  Then followed with mountains, fish and man:
And still there is an abundance of water,
  But it must be pure as it was first planned.
Since man has come to try to rule this universe,
  Sometimes he does the job real well, as inspired;
To others it seems that life has become a curse,
  The water has become stale or overcharged.
Now it's up to man to listen to the conscience voice,
  And build a mammoth disc* or a dial magnetograph—
Then with an oxyhydrogen blow-pipe of helium choice,
  Twill add much health to the Nation's staff.
It must be men of magnanimous power and greed
  To see the wealth that has been placed in store
For the multitudes that need an abundance of seed
  To better the ozone, then with the aid of the magnetometer
The zincode forced thru the zirconium and graphite
  Many cubic meters of putrid water that has been a fetter
A round the progress of man; when with the zeolite
  And chloride of sodium built into a huge tunnel;
This water will be forced thru the magnesium base
  With a velocity so vehemence that H_2O is palatable
From all sources, whether fetid or alkaline glase;
  This will purity as the oceans-blue green,
Will be the aqua regia to the vegetation when it flows
  With the magnetized elements: the huge tanks seen
Filled and sent to each particle that grows:
  Giving all mankind health, prosperity and force,
If he will follow the path of this God-given course.

* The disc quoted here was approximately ten feet over, and was handled by electricity, and was pumped directly from the water spot, as ocean, lake or well—then forced thru the second dial, after atoms broken up were again transformed into water and then fed to the necessary channels.

Slogan of the Month:

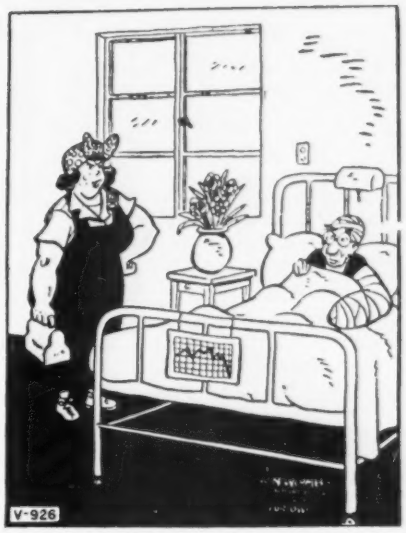
Perhaps You Can't Carry a Gun—But You Can Pay For One! Buy War Bonds.

Christmas Greetings

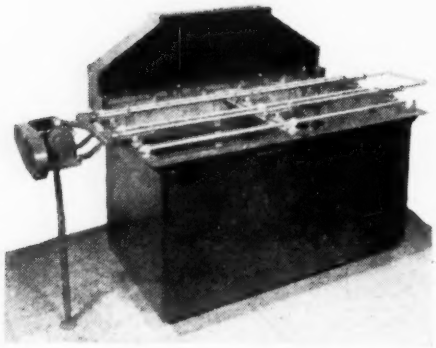
Christmas greetings were received from the following:

Agate Lacquer Mfg. Co.
Ann Baker
Joe Barron
Bart Messing Corp.
Bausch & Lomb Optical Co.
H. Leroy Beaver
T. R. Boggess
Adolph Bregman
Bryant Ribbon & Carbon Co.
T. W. Cleworth
Mr. & Mrs. S. L. Cole
Denham & Company
Lionel de Waltoff
Domestic Novelty Co.
Harry Einstein
Federal Tel. & Radio Corp.
Father Flanagan
Bernie Gaffney
The B. F. Goodrich Co.
George Grupp
Mr. & Mrs. F. J. Hanlon
Mr. & Mrs. G. B. Hogaboom, Sr.
H. A. Hooker
Mr. & Mrs. Zachary Irenas
Thalia & Franklin Johns
Knapp Engraving Co., Inc. and
Knapp Color Plate Co., Inc.
The Lea Mfg. Co.
Mr. & Mrs. Robert Leather
Chas. F. L'Hommedieu & Sons Co.
Cecilia and Leslie Linick
Luscombe Airplane Co.
Mr. & Mrs. W. D. MacDermid
Maisto's, Inc.
F. C. Mesle
Thomas E. Miller, Hercules Powder Co.
Pauline Munning
Oakite Products, Inc.
The Puritan Mfg. Co.
Andrew V. Re
Franklin Roberts
Sellco Plating
Leslie Smith
Surety Electroplating Co.
O. S. Tyson & Co., Inc.
Philips Webb Upham & Co.
Universal Engraving Co.
Jos. Waldman & Sons
Samuel Wein
Thomas A. Weiss
T. J. Williams

Thank you! And Cordial Greetings and Best Wishes to All Our Friends!



"IF YOU WATCHED YOUR MACHINE AS MUCH AS THAT BLONDE YOU WOULDN'T BE AN ABSENTEE!"



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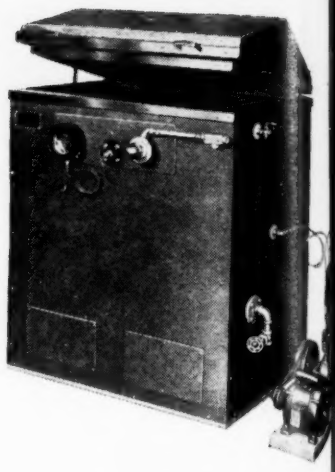

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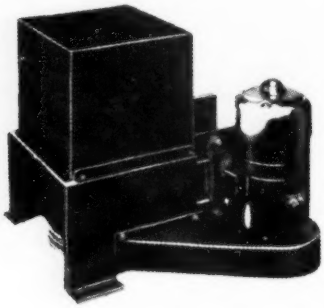

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